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Correspondence.—Wishing to make this Journal a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of these subjects a pleasure or a profession.

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[OFFICIAL NOTICE.]

PHILADELPHIA, June 5th, 1879.

CHAS. NETTLETON, ESQ., NEW YORK—

Dear Sir: At the last meeting of the American Gas Light Association, held in New York in October, 1878, it was decided to hold the next meeting in the City of Philadelphia, on the 15th, 16th and 17th of October, 1879, and a committee was appointed "to make the necessary arrangements for the session."

In pursuance thereof the committee respectfully solicits the various manufacturers of gas apparatus, who may desire to participate in an exhibition of their respective articles, to make application to the committee on or before the 15th day of August, setting forth the nature of apparatus, and space required.

All communications to be addressed to

HENRY CARTWRIGHT, *Chairman*,
209 *South Third Street.*

ASSOCIATION MEETINGS.

There is one point that it is unnecessary to impress upon gas engineers and managers of works, and that is the value that may be derived from the interchange of ideas and experience which results from the meetings of the various associations which have been formed from time to time. But it is a fact that comes to us often, that the directors and officers of companies do not always understand that the benefit which the engineer or superintendent derives from these meetings is conveyed directly to the companies which they serve.

This is a point of importance to many whose salaries are not sufficient to warrant them in bearing all the expenses attendant upon going and coming to the meetings, which must of necessity be distant from many of the members. Liberality in paying reasonable expenses of this kind will prove a good investment, and directors should encourage their engineers not only to study at home, but when opportunity offers for meeting a large number of men engaged in the same pursuits, means should be found to enable the company to get the fullest possible benefit to be obtained by consultation and discussion.

No engineer should have cause to say that he cannot go because he cannot afford it. Experience, both in England and America, proves conclusively that a saving of many thousands of dollars has resulted from the formation of these associations.

Since our last issue the Annual Meeting of the British Association of Gas Managers has been held, and we hope to be able to give a full report in the next number of the JOURNAL.

The growing demand for correct information, classified facts, which constitutes knowledge in the gas business, is one of the best signs of the times.

It has been found, from experience in England, that the more local associations there are formed, the better the character of the meetings of the general Association become. So far from destroying the interest, the effect is to improve it. As a matter of course, every member cannot attend the meetings every year; but if smaller local societies are formed they can meet more frequently, the members exchange and acquire useful information, and those who do attend the general meetings come better prepared, with larger ideas, and with the advantage of thought and study which has been the result, in many instances, of discussions and statements which have taken place in the smaller local societies. The same will be found true in this country, and it may be a question whether our National Association can become all that it should be until the number of local societies has been largely increased.

Our readers have been made aware of the progress that is being made in this direction, by the reports that we have given of the organization of several new societies during the past year. In our issue of June 2d the proceedings of a meeting for organization, in Syracuse, of the Central New York Association; in the number for June 16th were given the proceedings of the first annual meeting of the Western Gas Association; and, during the year, the Oil Gas Association was formed in Ohio. Besides these there were already in existence the New England Association of Gas Engineers, in Boston, the Society of Gas Lighting in New York city, and the New England Gas Club, in New England.

The amount of real good that may be done by these different Associations is very great, and their influence is wide spread; and we trust that before

the close of another year, we may be able to announce the proceedings of an association in the Southern part of our land, while others might be formed in many of the States of the Union with most beneficial results. We are ready to publish the fullest possible reports of all these meetings, and trust that, in all cases, the secretaries will send us the reports promptly, not forgetting to send the papers that are read.

We were much amused at the part of the proceedings of the Western Association which proposed to make the *Plumber and Sanitary Engineer* their "official organ"; while they could not have suggested a better Journal, outside of their own, still we cannot but think that that Journal would have declined the honor, as it does not profess to maintain any official relations with any one. We would simply say to our Western friends, who do not find our columns what they should be, send along your matter, contribute your quota in correspondence, new subscriptions and advertisements, and every additional dollar shall go to make the JOURNAL better. We make no claim to perfection, but urgently strive for improvement, and expect you to assist.

PRECEDENTS IN PRIVATE LEGISLATION AFFECTING GAS AND WATER COMPANIES.

By G. W. STEVENSON, C.E., F.G.S., London.

Through the courtesy of the author we are in receipt of this very valuable work.

In the Kingdom of Great Britain all gas and water undertakings are regulated by law. While the legislation is general in its character, still, in almost every case, when a company comes before Parliament for additional powers, some special modifications of the general laws are sought, which in some cases are granted, and, in some cases, the company does not get all the powers it asks, but has conditions imposed upon it which it did not seek or desire. The result of this is quite a complicated amount of legislation on the subject, involving a great variety of special provisions.

The object of the work referred to above is to give, under appropriate heads, in a classified form, the result of this legislation; and, also, the date any number of the act in each case, so that those desiring full particulars as to what has been done, in any or all cases, may, by reference to this book, find exactly where to look for the details not contained therein.

It has involved much labor, and while of not so much interest to gas companies in this country just now, yet, should any company desire to obtain or oppose legislation, we know of no work that would be of so much value, from the fact that it embodies practically all the English legislation in every department of the business up to the close of 1878—giving many details, such as the capital authorized, the illuminating power and purity required, the amount of dividends allowed, the price of gas, etc., etc.

As a compendium of condensed and useful information it should merit a large sale, even at the price of one guinea, and should be in every gas library that makes any pretensions to completeness.

THE PLUMBER AND SANITARY ENGINEER.—It is with pleasure that we note the prosperity of this new enterprise. The good that has already been done by this Journal, in producing a healthy and sensible discussion of sanitary topics, is not easily estimated. With the month of June it commenced as a semi-monthly instead of a monthly publication, and we have no doubt that its readers will find that it doubles in interest as well as in the number of its issues.

PERSONALS.—Mr. Jas. Somerville, lately at Montgomery, Ala., and formerly at Knoxville, Tenn., has been appointed engineer and superintendent of the Gas Light and Coke Company of Indianapolis, Ind. Mr. H. Stacey, who for several years has held this position, having resigned.

Mr. W. B. Mills succeeds Mr. Somerville at Montgomery.

Mr. W. G. Abel, late assistant superintendent at Indianapolis, takes charge of the Chattanooga gas works as secretary and superintendent, Mr. C. E. James having resigned.

[OFFICIAL NOTICE.]

BOSTON, June 25th, 1879.

At a Meeting of the President and Directors of the New England Association of Gas Engineers, held on the 19th ult., it was decided to hold the semi-annual Meeting at Providence, R. I., on August 13th and 14th. Headquarters will be at the Narragansett Hotel, and the arrangements will include excursions down Narragansett Bay, touching at Rocky Point, Silver Spring, Newport, etc. The committee of arrangements intend to make the occasion enjoyable both socially and professionally.

GEO. B. NEAL,
Secretary.

[From the London "Journal of Gas Lighting."]

Midland Association of Gas Managers.

At the Sixth Quarterly meeting of this Association, held at Birmingham, on Thursday, May 1, Mr. Charles Hunt, of Birmingham, the President, in the Chair, a paper was read by Mr. C. E. Jones (Chesterfield), on

PUBLIC LIGHTING, WITH SPECIAL REFERENCE TO STREETS, ETC.

The paper commenced with a few remarks on the use of artificial lights in the past ages. It then proceeds: But we pass on to treat more particularly that branch of our industry selected for to-day's consideration—viz., public lighting—the discussion of which I hope may interest and benefit each one of us. It is a subject that certainly has not received too much attention, and perhaps its unremunerative character is responsible for the lack of interest manifested in its development; but even this consideration should not deter us from endeavoring to bring to perfection every branch of our profession.

The chief requirements of public lights are—(*a*) steadiness of flame, not susceptible to atmospheric commotion; (*b*) uniformity of intensity; (*c*) great penetrating power; (*d*) great diffusive power; (*e*) ever available without preparation, and easily lighted; (*f*) non-liability to any sudden or self-extinguishment; (*g*) shadowless; (*h*) commercially cheap.

The first of these is effected by the kind of burner used, and the form of lantern employed to shield the light. Upon the selection of the material to produce the light depend *b*, *c*, *d*, and *e*; *f* is chiefly a matter of interruption in supply or mechanical defect; *g* refers to the form of support and the structure of the lantern; *h* we will consider collaterally.

In the wide range of materials from which artificial light can be produced, that which fulfills most of the above requirements is coal gas. No other source of light at present known possesses the inherent qualities of coal gas in anything like a corresponding degree, and the light-givers which the more nearly approach it have a similar composition, being hydrocarbons. Candles and oil have been tried over and over again, both remotely and recently, with the result of leaving coal gas the master of the situation. To coal gas, then, the public returns, being won back to the old love by its many excellent and unique qualifications; and if we this day advance the just claims of coal gas, and bring out more prominently than hitherto its usefulness and special features, we shall not have spent our time in vain, however imperfectly the subject may have been put before you.

To secure a successful combination of the above conditions may be considered by some to be practically impossible, the nature of the service demanded being of such a varying character, depending upon the union of circumstances exceedingly difficult to effect; but if we cannot insure theoretical perfection, we must strive to secure a position as near to it as is possible in our particular and individual cases.

By a little study of the foregoing principles which I have submitted to your consideration, and careful attention to the details of their application, considerable improvement can be effected in public lighting without any very great outlay. Some excuse may be found for our forefathers upon the ground of ignorance; but that cannot apply to ourselves in the present day, when knowledge is universal. The ancient cry was, "Where shall wisdom be found?" Now the answer is, "It crieth on the housetops," and knowledge, says Solomon, "increaseth strength;" so that if we are already strong, the increase of our knowledge makes us stronger, and the future of all undertakings is safe when directed by the "excellency of knowledge." Let us, then, widen the foundations of our professional fabric by showing the public which is the right path to tread, the right way to use the light they pay for for street illuminations, and if they refuse to follow our advice and direction, we shall still possess the consciousness of having done our duty.

Before the introduction of gas lighting, very little sound knowledge existed generally of the laws that govern the combustion of inflammable bodies; and much of the extraordinary progress made by science is attributable to coal gas. This accounts, to a large extent, for the want of success attending the earlier efforts to light thoroughfares.

The earliest forms of oil or candle lamps that I have met with were apparently designed by unskillful people, totally ignorant of the commonest principles of combustion, and no effort was made to obtain the maximum amount of light from the materials at their command. We find some with scarcely any air-ways, or perforated in such a manner that the carbon became deposited in graceful festoons of soot, which you will agree with me is "matter in the wrong place" in a lamp, rendering the instrument practically useless for the purpose for which it was intended. When coal gas superseded oil as a public illuminant, the old form of lantern was retained and largely used, or others made in partial imitation of it, and to this circumstance may be traced some of the evils attending the present system of street lighting. Had we to begin *de novo* without such examples to

follow, or vested interests to consider, far better and more suitable lamps would be produced, and the public lighting rendered much more effective.

To make matters worse, when gas works became multiplied, no particulap pattern of bracket or lamp column was adopted. No uniformity in height, strength, size, or distance apart was observed by engineers. Each put into practice his own ideas of taste, or what he thought the best for the locality he had to illuminate, regardless of the physical principles of light or the chemical laws of combustion. Hence we find an astonishing variety and diversity of the shapes in both lamp columns and brackets, some being designed with filagree work, called "ornamental," and so placed as to obstruct the downward rays of light, and darken most effectually the pavement in the immediate neighborhood of the lamp. This desire of ornamentation extended to the lanterns, and scroll-work added its shadow to that of the support, while the metallic ribs and angles were made so wide as to amount in some cases to 10 per cent. of the whole surface of the glass, and consequently augmented the evil. Uniformity in the rate of combustion was disregarded, or a quantity per hour adopted without due regard to the quality of the gas to be supplied, and when a town was well lighted, it was more an accidental circumstance than otherwise.

I have observed in many towns new lamps being put up which embodied all the defects of the old ones, and, of course, with a like result. The public lighting of the Metropolis, except in certain places, is perfectly disgraceful, and reflects no credit on the companies or the local authorities; while in Birmingham, with every deference to our valued President, a state of things exists which is little better.

In many large towns, notably in Scotland, where the street lighting does not appear to be of the slightest consequence, or else is regarded with very little interest, the effect is most disappointing, particularly when we remember the high illuminating power of the gas there as compared with places in the South. There is scarcely a town with which fault cannot be found, though it must be confessed that there are a few in the South that are fairly lighted, and I hope before long to witness a general improvement in this much-needed direction. Of course, the change will not be a sudden one. The capital invested in lighting plant cannot be sacrificed; but when renewing broken lamps, or rearranging their situations, much can be quietly effected, whilst in new streets or districts no obstacle can interfere to prevent the adoption of suitable light-giving apparatus.

It is evident that designers and manufacturers have not paid attention to this branch of the subject, inasmuch as the designing and manufacturing of grotesque columns and brackets is still going on. In bracket lamps, instances might be advanced *ad infinitum* of intricate designing of ornamentation, and flagrant disregard of the physical properties of light, and so long as encouragement is given to manufacturers to elaborate these articles in opposition to good taste, in defiance of common sense and the true principles of utilitarianism, so long shall we be doomed to have badly lighted streets and thoroughfares, and so waste the light-giving power of the gas.

Not only is the designing and constructing of lamp columns, brackets, and lantern frames defective, but oftentimes the commonest glass is used for glazing, and a great interception of light takes place from this cause alone. After putting a good light into a lamp, it is not at all an uncommon thing for a lamp contractor to obscure it with dim and gloomy glass.

Glass, as you all know, is manufactured by fusing silicic acid with carbonate of soda or potash. The transparent material so obtained is incapable, however, of resisting atmospheric influences, and water alone will dissolve it in time. The glass maker, therefore, has to add small portions of lime or baryta, or the oxides of iron, lead, or zinc, to enable the compound to resist the action of the atmosphere. The commonest glass consists chiefly of silicate of lime, some proportion of the silicates of the alkalies, of alumina, and oxide of iron. Some kinds of window glass are very little better than the commonest bottle glass; and we shall therefore find it of service to us if we pause to consider the composition of glass, since more depends upon the quality of this material than many people suppose.

The composition of window glass is usually as follows:

Soda	23.3 per cent.
Lime	12.9 "
Silicic acid	61.1 "

with a trace of alumina. Now, soda imparts a green tinge to glass, so much so that in the manufacture of crown glass, the variety largely used for optical purposes, it cannot be used, and potash has to be substituted, the proportions usually being—

Potash	22.0 per cent.
Lime	12.5 "
Silicic acid	62.0 "

According to an analysis of Faraday, English flint glass has the following composition—

Silica	51.93 per cent.
Oxide of potassium	13.77 "
Oxide of lead	33.28 "

A small proportion of the oxide of iron gives a dark color to glass, and it is as well to remember, when selecting glass for lamps, that, next to its brilliancy, its power of resisting atmospheric influences should be considered. In manufacturing towns the atmosphere soon destroys the polish of the surface, and cheap glass is soon "etched" in this way. It is therefore more economical to use a clear, brilliant, hard glass, though its first cost may be more than many of the dull wavy varieties manufactured from gas lime, soda waste, clay, and rock salt, and largely used by speculating builders for windows, and unwise gas managers and avaricious lamp contractors for street lamps. The rougher the surface of the glass, the sooner does it become dirty, and the more readily are the rays of light intercepted; whereas a good clear, smooth glass will keep cleaner for a longer period, and allow the light to pass readily through.

Whatever media are used to inclose the light, it is inevitable that some loss will be sustained. This loss is not invariably the same for the same medium, but varies with the penetrative power of the flame, and likewise the distance from the flame. The larger the flame the smaller the loss up to a certain point; thus a strong argument is supplied in favor of larger burners in street lamps. Some experimentalists have arrived at the conclusion that window glass occasions a loss of light equal to 9 per cent.; but unless we are told what kind of window glass was used, this statement is certainly vague, if not misleading, glass of nearly all qualities, with varying powers of light-interception, being used for windows.

The following are the results of my own experiments, conducted with great care, every precaution being taken to eliminate all sources of error:

The first series of experiments were made with a pane of clear, hard 150z. English glass, quite new, free from flaws, and possessing a good polish, but identical with the kind I use for street lamps; the only difference being that care was used in its selection—in fact, it was the best of its kind. The illuminating power of gas used was 16.25 candles, and the loss of light by the interposition of this glass was only 1.78 per cent. Having procured from a glazier a similar sized sheet with wavy lines and air globules or bubbles in it—a wretched specimen, though perfectly new and clean—I found the loss of light to be 14.38 per cent.; therefore, by using this common foreign glass for glazing lamps, we sacrifice some 12½ per cent. of the light rays, which would otherwise be utilized by employing a glass equal to that used in the first series of experiments.

I next tested a pane of glass that had been in use for some time, and purposely allowed to become dirty, and to some extent also smoky. The result was remarkable, no less than 83.81 per cent of light being obstructed. The same glass, even when clean, intercepted 16.92 per cent. of the light. This demonstrates the desirability of more frequent cleaning, and also exhibits the etching power of the atmosphere when charged with impurities, and the feeble resistance offered by the glass to its chemical action. By subtracting the percentage of the first-named experiment from the 16.92, thus: 16.92 — 1.78, we have 15.14 as the percentage of obstruction due to the corrosive wear of the glass when subjected to atmospheric influences in a manufacturing district containing chemical works and potteries. It would be interesting to know in what period of time this deterioration or etching was effected; but that information, I regret to say, I am unable to give with strict accuracy, notwithstanding that I believe I am quite safe in this instance in putting it at from three to four years.

Red and ruby glass is frequently used for private lamps over shop doors, hotels, etc. I find their power of intercepting light varies with the intensity of color, and not so much with the thickness of the glass, as one would almost expect. A very thin specimen intercepted 61.36 per cent. of the light, while a sheet very much thicker only obstructed the light rays to the extent of 51.76 per cent.; the average of all my experiments being 48.08 per cent. Red glass is produced by the addition of suboxide of copper, and the finest ruby glass contains a little gold, 1-100th part of a grain of gold being sufficient to impart a deep rose color to a cubic inch of fluid; while oxide of cobalt is used to produce the magnificent blue which usually adorns the portals of police stations. Such glass, when quite plain and without clear spaces upon it, such as the word "station," etc., obstructs artificial light to the extent of 38.13 per cent. Various experiments with ground sheet and other ground glass induced me to place the loss of light at 22.32 per cent., while glass colored yellow by the oxide of antimony only intercepted 11.64 per cent. of light.

In the laying of gas lamp services workmen are often either too idle or too ignorant to select good soil with which to surround the pipe. In corrosive soils, such as contain the compounds of iron, lime, and acids, pipes are soon destroyed or "eaten away," and the least subsidence or disturbance of the surface—oftentimes the vibration of the roadway caused by the passing

traffic—is sufficient to occasion a leakage of gas. In the absence of casing, the durability of service pipes may be increased by surrounding the pipe in the trench with mould, sawdust, or clay, and the latter is much better if burnt. This should extend the whole length of the pipe, and not be put in the trench at intervals.

I have here a sample of lead pipe eaten away by plaster made partly with ashes from a colliery. The destructive action of this material can be more easily imagined when I tell you that four months sufficed to effect the ruin of the pipe. I have frequently taken up from streets iron pipes presenting similar features, and I have no doubt the members of this Association have had similar experience.

Where the substratum of roads and streets consists chiefly of ashes and cinders from factories, steam boilers, and so forth, the life of lead or iron pipes is of short duration, and since we have no power to direct road authorities, or to specify and compel the use of certain materials in road-making, we must endeavor to preserve our distributing apparatus by adopting every precaution in our power, with the view of increasing its durability. It is a good plan to give iron pipes a coat of paint, allowing the same to dry and harden before the pipes are used. After many years experience, I find the preservative properties of coal tar very efficacious, and I still use that residual for painting wrought iron services. Lead services for gas I invariably inclose in wood, and no doubt it would in many cases be economical to encase wrought iron ones in a similar manner.

Of stoppages by frost or naphthaline little need be said; but next to the application of heat, I have found spirits of wine or benzole useful agents in removing the obstructions so caused. By abolishing elbows and sharp corners, much trouble would be saved gas managers in frosty weather, as obstructions usually commence in elbows, while bends are comparatively free. Service pipes laid at an insufficient depth in the ground, or in intensely cold situations, favor the deposition of naphthaline, and bring a train of evils at a season when general managers of gas works have sufficient to occupy their attention without the luxury of frozen lamps. The size of the pipe, too, should be ¾-inch underground, and not less than ½-inch to the cock, provided the ingenuity of the lamp post maker has not effectually debarred you from putting in a suitable sized pipe. In some of the older columns it is impossible to get even a ¾-inch pipe through the neck of the post, and I have found it necessary to place the service pipe outside, instead of inside the column, where, of course, it would be protected.

To have to contend against the idiosyncrasies of pattern makers and ironfounders, in addition to our other multifarious duties, is a grievous imposition which calls loudly for redress, if not justifying open rebellion. Manufacturers of lamp columns, like chandelier makers, evidently believe that one size of pipe is equally applicable for one light or ten. *O tempora! O mores!*

The painting of lamps, brackets, and columns may appear as a small matter, but upon the color of the material employed for the purpose depends a great deal of the success of reflecting the rays of light. Since black absorbs all the rays of light, and white, on the contrary, reflects them, white paint must be the most suitable material considered in this sense, possessing as it does the highest reflecting power. In manufacturing districts, however, white is an expensive paint to use, on account of the short time it keeps clean; nevertheless it can be advantageously employed in many towns. All lanterns should be painted white inside, and the columns or brackets as light a color as circumstances will permit; and it is high time that the practice of painting about half an inch of the glass, as well as the metallic frame, should be discontinued. Such artistic work by lamp painters should be executed elsewhere, it being decidedly objectionable on a street lamp.

Considerable improvement might be effected in street lighting by the more frequent cleaning of the lamps. In the Metropolis, if I remember rightly, the lamps are cleaned twice a week; but the practice in most provincial towns is to clean once a week. In summer time perhaps once a week is enough in some places, but in the winter months lamps require cleaning twice a week, and it would be well if local authorities could be induced to pay the slight additional cost of such service, and thereby increase the lighting power they grudgingly pay for. As the cry now is "More light," here is a cheap and easily available source of its augmentation for the purposes to which this paper refers, and I commend its consideration to the uthorities interested.

Good burners, suitable for the quality of the gas supplied, are indispensable for success in public lighting; and since it is almost impossible, from causes familiar to us all, to maintain the pressure in the distributory apparatus at one uniform point, governors, capable of delivering a constant volume per hour within a reasonable range of variation of pressure should be attached to each burner. Regularity of supply, steadiness of flame, and uniformity of amount or of volume of light, are consummations "devoutly to be wished" in street lighting, and I know of no instrument more likely to assist in the attainment of these considerations than a properly constructed lamp governor. Too little attention has been bestowed upon burners. It is no uncommon sight to see a lamp, costing some £5 or £10, lighted with a vile burner that might have cost the extravagant sum of one penny, and if such a mean and contemptible detractor of the illuminating power of coal gas does not succeed in bringing the gas manufacturer into disrepute, as well as in creating numerous collateral annoyances, it will be a matter of profound amazement. The lamp governor maker has, of necessity, to test his governors with gas in order to ascertain soundness of workmanship, and accuracy of adjustment, and in so doing he tests the burner at the same time, and if it happens to be a bad one he rejects it and substitutes a better. Here, then, is a guarantee that the burner is a reasonably good one; still, the gas manager will find it to his advantage to frequently try his lamp burners and governors, as a check upon undue consumption of gas, and upon the governor manufacturer.

The normal rate of consumption for common gas I shall assume to be 5 cubic feet per hour; for cannel gas it is much less, usually 2 to 3 cubic feet. Now, remembering that the intensity of artificial light such as coal gas is increased in a greater ratio than the ratio or the cost of the illuminant, it is most unfortunate that the normal rate of consumption for street lighting has drifted so low as 5 cubic feet. For common, or 16-candle gas, 6 feet should certainly, in my opinion, be the minimum; and as I venture to think that the days of cannel gas are justly doomed, and to hope that Parliament will ere long establish a uniform and universal standard of gas light—thus removing the anomalies in this respect that at present exist—cannel may be left out of consideration just now. But I trust, Mr. President, you will permit me to observe, *en passant*, that I consider, with our present burners, patent or otherwise, gas exceeding 20-candle power of no advantage to the general public.

The size of service pipes attached above ground to lamps with single lights, as mentioned before, should not be less than ¾-inch, carried to a point as near the lamp as convenient, with a lamp cock having a long and a short arm, to indicate, by its position during the day, when the cock is shut, and the flow of gas stooped. From practical experience of the carelessness of lamplighters, I am driven to the conclusion that quantities of gas are wasted by imperfect gas cocks, and the thoughtlessness, rather than the wilfulness of the lamplighters.

The height of the lamp columns and brackets is very varying indeed, and I am disposed to think that the average height might be reduced with benefit to the thoroughfares and the traffic thereon. In my own district the range of variation extends from 9 ft. 6 in. to 14 ft. 9 in. I have no hesitation in recommending, for columns 70 yards apart, a height of 11 feet from the ground to the centre of the flame. The same applies to bracket lights, where it is practicable to fix them at this height, although it so frequently happens that brackets are subject to an arbitrary rule, and very little choice is left in the matter, as they often have to be fixed between doors and windows, panels, and in similar places, or not at all.

The old ladder-lighting I shall assume to be extinct, and suppose the pole lamp to be universally used for lighting street lamps. The number of lamps a man can light with the pole lamp being much greater than with the ladder, the economy in wages should insure it adoption; though I must confess that room exists for considerable improvement in the construction of pole lighting lamps, and I hope ingenious inventors will give us something less cumbersome than those of the present forms. The number of lamps a man can light in an hour will of course depend upon distance, or, technically speaking, "the run." The closer the lamps, the larger number a man can light in a given time. The physical conformation of the district, the hills and dales, will retard or accelerate his speed; and the facility with which he can turn the tap, light the gas, and withdraw the lighter, will, of course, influence his work materially. As a general rule, a lamp takes an average of 25 to 30 seconds to light, and this is a fair speed for a lighter to keep up with lamps 70 yards apart.

The simultaneous lighting and extinguishing of street lamps is, however, greatly to be desired, and inventions like that of Mr. St. George Lane Fox, in which electricity is the agent employed, appear to evince the greatest promise of success; but until that good time comes we must plod along with the best means we can obtain.

It would be too great a trial of your patience to allude, however briefly, to a tithe of the numerous inventions bearing upon this part of the subject, and also upon lanterns. Suffice it to say that I cheerfully bear testimony to the excellence of many of them, and would not wish to write one word to discourage the inventive energy of those who are working in this direction. There is a large field and full scope for time and talents in the area covered by the title of this paper, and, although it may seem somewhat ungenerous not to notice the efforts which many men have made, and the results they have secured, such a course cannot, for the reason stated, be followed in this instance. The same applies to the lime light, the albo-carbon light, and others; but it would perhaps be scarcely pardonable if I omitted to allude to a light which has recently exercised such a depreciating and

disastrous influence upon gas property in this country—a light by no means new, but one that has within the last few years made wonderful strides toward the goal of perfection.

It would ill become us as disciples of science and searchers after the secrects locked up by truth in the world of scientific research, to complain of or lament over any discovery, or any adaptation of discoveries, likely to lead to a result beneficial to mankind. As scientific men, we rejoice that the march of intelliectuality is onward, onward, and onward, and we cheerfully welcome any discovery or invention that will afford intellectual gratification, or add to the comfort and welfare of the world. Animated by these feelings must every one have been who witnessed the experiences with the electric light at the Curzon Hall, this town, in October last. For myself, I went on to London that night, and acquired what information I could respecting what was thought to be a powerful rival, and the ultimate annihilator of the gas industry.

I have formed the opinion, which I have publicly expressed, that this light, in its present stage of development, can scarcely be called a competitor with coal gas, where that article is sold reasonably cheap. If coal gas were seven or eight times the cost it is, some colorable pretence would exist for anxiety respecting our industry; and even then the many advantages possessed by coal gas would effectually preclude the possibility of its being superseded by electricity. But let it not be supposed for an instant that we are prejudiced against the electric light because it is produced from a source distinct from that which evolves coal gas: on the contrary, we welcome all improvement, and if any think the world is to stand still, like the heavenly bodies did at the command of Joshua, for their convenience and interest, they resemble the foolish virgins who neglected to keep their lamps in trim, and I verily hope that none such belong to our profession. However, as the custodians of the capital invested in gas undertakings, we should fail in our public duties did we remain silent or neglect to use due vigilance, or to exercise honest criticism, or to relax in our efforts to serve our respective boards or committees with all our might, or to satisfy the reasonable demands of the public. There is nothing that electricty has done within the range of the title of this paper, but that can be easily accomplished by coal gas. Do you require a small, certain, and controllable light? Gas is at your elbow, and at present electricity is not. Do you wish for large and intense lights? Gas is your willing agent. From the faintest glimmer of a rushlight to the concentrated glare of 3,000 standard candles, is a range of radient power possessed at present by no other artificial illuminating agent in the world.

Upon the experimental tests of such eminent men as Dr. Tyndall, F.R.S., and Professor Valentin, the Wigham burner, with 108 jets, consuming 308 cubic feet of cannel gas, gave a light equal to 2,923.4 sperm candles burning 120 grains per hour. Now, 108 cubic feet of cannel gas would probably cost 6d. or 7d., and what would be the cost of electricity to produce the same amount of light? According to the committee appointed by the Gaslight and Coke Company to ascertain the relative power and cost of electric light and gas, the cost of producing by electricity a light equal in intensity to 1,727 candles is, if worked by a steam engine, 4s. 6d. per hour; if worked by a gas engine, 3s. 3d. per hour; and, if the light be shaded by opal glass, 50 per cent. of the light being intercepted, the cost is 9s. per hour.

Col. Haywood, the engineer and surveyor to the corporation of the City of London, estimates, from trials made in the Metropolis, that the cost of the electric light light is 7½ times that of gas. This is independent authority, and worthy of all acceptation; so that we will take 4s. 4d. per hour as the cost of a light approaching that mentioned above.

Notwithstanding its great cost, the electric light is a most useful one, and for some classes of work, where expense is no object, and time or circumstances will not allow of the production and use of gas, it will doubtless be largely employed; but where gas is available, as it always is in towns, preference will be given, on the score of economy, to the chief commodity of the gas engineer. The products of combustion, too, of coal gas are, I believe, far less injurious than the compounds of nitrogen produced by the electric light. The compounds of sulphur and oxygen are for less chemically active than compounds of nitrogen and oxygen; and the extensive use of the electric light in buildings or close rooms will not long be tolerated by those who have used coal gas. Even the fishmongers and traders at Billingsgate Market, after a trial of electricity, penitently returned to their old love—coal gas.

I take it, sir, that our duty is to endeavor by every means to improve our chief commodity, by eliminating actual or hypothetical impurities, to cheapen still more its production, develop its manifold and latent qualifications, and popularize its use. By the adoption of this policy, the best interests of gas proprietors will be consulted, the wants of the public served and the credit of our high profession maintained.

Some time since I was called upon to light up a new district, and I determined to put into operation ideas which I had matured a long time before. Not having a lamp column that suited my taste, I sketched one. It is, as you see, a somewhat plain fluted pillar, affording no "coign of vantage" for the exploits of mischievous boys, whose special mission appears to be to do that which ought not to be done, and to leave undone the things which ought to be done. Every such "coign" is convex or beveled off, so that no foothold is obtainable, and the sharp edges of the flutes are by no means comfortable to handle. Notwithstanding this, it is not deficient in ornament. The height from the ground-line to the centre of flame is 11 feet, and the chief feature is the large space allowed at the top. Objecting as I do to lamps being attached at the bottom, the frame is continued upward to receive the lamp, which is an ordinary square one, made a little longer than usual. The rate of consumption is only 5 feet per hour, and with this quantity the minimum of shadow was thrown on the pavement. The head of the lamp is certainly light, but when made of best Staveley iron it is quite strong enough to withstand any gale. The entire weight is 3¼ cwt.

The average distance of the lamps apart was 83 yards, and the success of lighting was so great that the residents in the older parts of my district complained that I had bestowed special favors upon the Newbold Local Board, and lighted up their district more efficiently than any other. The fact of the glass being new, and care having been exercised in its selection, increased considerably the radient effect produced. From what I have said respecting the interception of light by various kinds of glass, you will readily admit this.

You will probably ask why the lamps are made so much longer than ordinary ones. You will perceive the angles of the frame are continued till they meet. In experimenting with lanterns, I conceived the theory that if the edges of the frame were broader than the base of the lamp, the shadow would be destroyed. In order to demonstrate this the new lamp was constructed, and with a batwing flame it gives no shadow; but a lamp of that length is inconvenient in some respects, and by shortening it by degrees I finally determined upon a suitable shape. To insure steadiness of flame, I adopted means for the regulation of air at the bottom of the lamp, and the result is satisfactory in every way. I would strongly advise all gas managers to adopt this form of lamp, which will fit the ordinary 14-inch frame, can be made by any tinman, is easily cleaned, and will effect, at a trifling cost, a great improvement in street illumination. It measures 6 inches at the bottom, 14 inches at the frame; its lower part is 2 feet long, and the roof 7 inches high, exclusive of wind guard.

The powers possessed by local authorities over public lighting are extensive and varied, differing greatly as between limited liability companies, non-statutory companies, those under Provisional Orders, and those incorporated by special act of Parliament. The earlier powers of public bodies over public lighting are to be found in ancient charters, special Lighting Acts, and in the old Watching and Lighting Act of 11 Geo. IV., c. 27. This was repealed by the 3 and 4 Wm. IV., c. 90., but all the former powers and penalties are re-enacted.

Coming down to later times, the 12 and 13 Vict., c. 94, gives local boards of health power to contract, for any period not exceeding three years at one time, with any company or persons for the supply of gas, oil, or other means of lighting the streets, roads, or other open places within their respective districts, and the expenses may be defrayed out of the general district rates levied under the said Public Health Act. The Legislature appears to have had some misgivings respecting the honesty of the ancient purveyors of artificial light, and also of gas undertakings, and they inserted in the general acts very stringent clauses for the protection of the consumer and the punishment of the contractor or the company. Illustrating as it does the fidelity with which gas companies fulfill their legal obligations, these penal clauses are very rarely put into active operation, the companies being so seldom in default.

In 1847 the Gas Works Clauses Act, or the 10 Vict., c. 15, was passed, and in 1859 Lord Redesdale brought in a bill to secure a legal standard in the measurement of gas, and the Sales of Gas Act, 1859, and the Sales of Gas Amendment Act, 1860—most useful acts—were passed. In 1870 the Gas and Water Works Facilities Act became a law. A year later, the Gas Works Clauses Act, 1871, was passed. The act of 1870 does not concern us at present, containing no enactment concerning the public lighting. The 1859 and 1860 acts refer to measurements of gas and its machinery for inspection, and, for a like reason, we may disregard them in this paper. The acts of 1847 and 1871, however, are directed to be construed together as one act, and the act of 1871 repeals and supersedes such of the provisions of the first-named act "as are inconsistent" with the latter. Section 24 of the 34 and 35 Vict., c. 41, practically hands over the control of the public lighting to the local authorities.

The Special Act or Provisional Order usually specifies the price of gas for public purposes, or the uses to which it may be applied and paid for out of the rates, and it has been the practice to make a reduction in favor of public lamps. Remembering that all ratepayers enjoy equally the benefits conferred by public lighting, and a large proportion of ratepayers

are not private consumers of gas in any way, I cannot subscribe to the unjust principle of selling gas to the *quasi* consumer at a lower rate than to the private and public consumer. That the buyer of the smallest quantity should be placed on better terms than the buyer of the largest quantity is an anomaly difficult to reconcile with commercial principles; but this is so whenever gas is supplied to public lamps at a reduced rate per 1,000 cubic feet.

It is obvious that the rate payer who only pays through his rates for gas supplied to the public lamps, obtains such gas on easier terms than the one who happens to be also a private consumer. Thus, assuming gas for public purposes to be sold at 2s. 6d. per 1,000 cubic feet, and for general purposes at 5s., it follows that A., who is only a ratepayer consuming his share of gas *via* the public lamps, obtains his gas for 2s. 6d., while B., being a large private consumer as well, has to pay an increased rate for his private consumption. So much money being required to pay the dividends of a company say, the larger proportion is contributed by the private consumer, and I am driven to the conclusion—and I am glad to be in a position to state that I am supported in that conclusion by many friends—that, to be equitable in price, no reduction should be made in favor of the public lighting. Another point worth remembering is that in many districts public lights are used for only four, six, or eight months of the year; whereas a private consumer is a constant customer, using gas all the year round, not even extinguishing on moonlight nights.

Of the average meter system I shall say but little. The framers of the 25th section of the Gas Works Clauses Act, 1871, were evidently neither engineers nor gas managers, or they would have put all the public lamps on meters direct, or at least have settled how many lamps were to be metered or unmetered. Whether they wished 1 per cent. or 50 per cent. of the lamps to have meters attached, they hesitate to inform us, and very graciously leave the parties interested to fight it out among themselves. As far as I have been able to learn, this "average meter indication" system is a delusion; it has been tried and abandoned. Important economical results have been reported from time to time as due to its adoption, but I venture to think that such economy is due, not to the supposed check by a meter, to so many lamps, but to the shortening of the hours of burning by the local authorities. With fair and open dealings between the officials of local authorities and the officers of gas companies, with confidence in man's honor and doing to others as you wish them to do unto you, the "average meter" system is utterly unnecessary, and the absence of its general adoption must be taken as a proof of its failure. If any member of this Association has the system in operation, I trust he will give us the benefit of his experience therewith, and show us the advantage conferred on the public by this system of supplying and charging for gas to public lamps.

Having now, sir, discharged my duty and fulfilled my promise, I must ask for forgiveness for the many imperfections to be found in this paper, and for the defective manner in which the subject has been laid before you. Considered with regard either to importance, its interest, or to its possible operation on the future of gas companies, no excuse is needed for its introduction to your notice to-day; and I venture to hope, sir, when you invite discussion, as you will do directly, upon the substance of this paper, that any member of this Association who hesitates to accept its tenor as correct, or who disagrees with the conclusions arrived at by the author, will avail himself of the opportunity, and express his views with earnestness, with thoroughness, and with force, in order that by the mutual interchange of ideas we may be assisted to establish scientific truth, increase more and more the value of our Association, and cement more closely our common bond of fellowship.

Amalgamation of Gas Companies.

At the last meeting of the Metropolitan Board of Works a report submitted stated that the Committee of the Board had, in reply to the communication from the Board of Trade, written to the effect that they entertained certain objections to the scheme for the amalgamation of the South Metropolitan and the Surrey Consumers Gas Companies; but it does not appear that any active opposition will be raised. The fact is that the amalgamation promises to be so beneficial to the consumers in the Surrey district that we fail to see what objections can possibly be urged against the combination. That the Company affiliated to the South Metropolitan Company will be subjected, after twelve months, to all the pains and penalties imposed by recent legislation, ought to be sufficient to satisfy the most exacting of the Metropolitan Board, and we are astonished that any remonstrance should be made against a scheme which involves so many benefits to a large section of the consumers of gas on the south of the Thames.

There is, we are happy to know, a possibility of a much larger combination, into which the Phœnix Gas Company will enter. It is unfortunate that this company has not been more prompt in responding to popular demands. A few years ago they might have taken the lead in a scheme intended to consolidate the interests of all the companies South of the Thames; but they allowed the opportunity to slip, and now have to take what may be called a secondary position. Nevertheless, the combination must, if effected, prove of great value to the Shareholders. The undertakings worked together would yield profits which would admit at once of a reduction of price, and consequently an increase of dividend. The fact is gratifying to both consumers and shareholders. The combination we speak of is only *in posse*, but we entertain the opinion that it is certain to be effected, sooner or later. Every kind of amalgamation we regard with favor. We have had no hesitation in expressing an opinion that it would benefit all if the gas supply of the Metropolis were under one management, and we have constantly urged that if this could not be effected, the northern companies might all be consolidated, and the southern companies be in a simular manner constituted into one united body. The objections of the Board of Works will probably have no weight with the Board of Trade, who favor amalgamation, and therefore we take it that the scheme is certain to receive their approbation. As to the Phœnix combination, we shall probably hear more. We only hope that it will be proceeded with and soon carried out. A meeting of the shareholders of the Surrey Consumers Company is called for to-day, to sanction the arrangement for amalgamation. We cannot suppose that any one would be so stupid as to raise an objection. The company urgently requires new works, and the infusion of new blood. They have not, at the present moment, any opportunity of increasing their storage, although they have facilities for the erection of new carbonizing apparatus and the reception of coal. The combination, as we had said, will assist them in both particulars, and we cannot believe that any shareholder will be led into the folly of opposing an amalgamation so desirable.—*Journal of Gas Lighting.*

[From the "Journal of Artificial Light."]

West of Scotland Gas Managers' Association.

[Continued from page 276.]

REMARKS ON THE ANALYSIS OF GAS COALS.

Mr. Andrew Scott, Falkirk, said—Mr. President and gentlemen. My attention having been drawn to the great difference which exists between the published analyses of gas-producing coals and shales, circulated by coal proprietors and others, and the results actually obtained by the ordinary process of gas making, I have ventured to bring this subject before you to-day in the hope that its introduction may lead to a discussion which may go to assist in securing gas managers a sound and more reliable basis to calculate from than what they have at present. On a coal analysis being presented to a gas manager, he first takes note of the four following points:

The yield of gas per ton; the illuminating power, and the quantity of ash and sulphur it contains. The two last are of very great importance, but as I wish to draw your attention to yield and illuminating power only, I refrain from saying anything about them. In the spring and summer of last year, while acting as assistant to my father at Galashiels, I tested a variety of coals in quantities of from two to three tons, and the results realized show, I think, how little reliance can be placed in the majority of analyses. The undernoted experiments, which are selected from my list, were made with good sound retorts and fair practical working heats. They include three first-class cannels, three third class, and three shales. The first figures quoted about each coal represent the published analyses, the second the results I got. The analyses were:

		candles.	
LESMAHAGOW AUCHENHEATH.			
gave	13,163 ft.	32·25	Hislop.
"	11,550 ft.	32·19	
Defic.	1,613	·16	
BANK.			
gave	10,806 ft.	27·28	Moffat.
"	10,020 ft.	24·3	
Defic.	786	2·98	
PIRNIE.			
gave	10,827 ft.	32.47	Macadam.
"	10,800 ft.	29·11	
Defic.	27	3·36	
NEWBATTLE.			
gave	12,573 ft.	33·8	Macadam.
"	11,500 ft.	32·0	
Defic.	1,073	1·8	
HABTLEY.			
gave	9,820 ft.	24·16	Wallace.
"	9,350 ft.	22 0	
Defic.	470	2·16	
FASKIN.			
gave	10,360 ft.	36·37	Wallace.
"	8,300 ft.	31·5	
Defic	2,060	4·87	
ARNISTON.			
gave	12,620 ft.	35·25	Macadam.
"	11,460 ft.	31·9	
Defic.	1,160	3·35	
FERNIEGAIR.			
gave	10,640 ft.	23·21	Hislop.
"	10,040 ft.	22·20	
Defic.	600	1·01	
WESTWOOD.			
gave	10,356 ft.	39·75	Dunlop.
"	9,530 ft.	34·0	
Defic.	825	5·75	

The difference between these tests give ample proof that the real commercial value of gas coal is not determined on a proper principle, as under ordinary circumstances it is impossible to get returns within from 10 to 20 per cent of those which are seemingly obtained by laboratory experi-

ments. This state of matters is very unsatisfactory, and often leads to very unpleasant circumstances. Many managers in small, and even moderately-sized works, have no proper means of ascertaining the value of coal for themselves, but have to trust entirely to analyses of this exaggerated description. Such men are placed in a very awkward position at the end of their financial year when they meet their directors, and are not able to show a return at their station meter of in some cases probably 2,000 feet of what they should have. The victims of analyses are immediately taken to task, for directors in most instances, being non-practical men, place implicit confidence in these elaborate reports made up by men of high scientific standing. In a couple of years, if managers took the right means, a complete revolution could be made in the system of coal analyses. When a coal is offered and its analyses presented, the manager should just say he does not put much faith in these things, but if the seller will guarantee that such results will be got and be agreeable to make a deduction for any shortcomings either in regard to yield or quality, he will be quite willing to do business with him. If this recommendation were carried out, I am confident that within the time I have mentioned we would be receiving analyses got by testing large quantities of the coal in a thoroughly practical way. This would put the question of yield an illuminating power at rest, and be an incalculable benefit both to buyer and seller.

The President—I must congratulate Mr. Scott on his sensible remarks, which are much to the point. As there are always two sides to a story, I shall be glad to hear what any other gentleman has to say.

Mr. Mitchell—I think this is a point on which Mr. Scott has touched rather severely. I do not think any gas manager here will take an analysis from any coal master, and get the same results. No reasonable man would ever expect it. Fifteen per cent. is the deduction from the laboratory analysis which is recognized. I never yet bought a coal from its analysis without making that deduction.

Mr. Hall, Berwick—We must give the coal merchant a little fair-play. One man takes one test, and another adopts a different test, and the difference often observed between the analysis and the actual make may be due to the manager and not to the coal master. There is only one coal that I have tested that came up to the analyses, and that is George's cannel. In this case the analysis is not even enough. Then I think that analyses ought to be more frequently made. We all know that the character of a seam of coal changes, and therefore I think it is desirable that there should be a more frequent analysis. The paper which has been read is very important, but I think the blame must be put upon ourselves, and not upon the results obtained. There is one thing, the importance of which has often impressed me, and that is if we could have a testing station a great benefit would be conferred on gas managers.

Mr. Hislop, Paisley—I may be allowed to make a few remarks on this subject. Altogether one is very much surprised at the paper. First of all the difference which Mr. Scott finds in practical from that presented under analysis, is not far to seek. The physical condition of the coal itself is sufficient to make the difference of 15 or 20 per cent. And then, in regard to the manufacture of gas, it would be most unfair to make the coalmaster responsible for the proper performance of a duty devolving upon the gas manager with respect to heats and the quantity of gas eliminated from the ton of coal. I hold that, as a rule, the difference between practical working of a gas analysis, should range somewhere under 10 per cent. It ought not to exceed that figure, if the necessary heats are retained and the retorts kept tight. I quite agree with Mr. Hall's remarks as to analysis. It is a well-known fact that when a coal-field is being wrought, a dyke or fault comes in the way, and that alters the character of the coal. I think Mr. Hall is not far wrong in suggesting that analysis should be more frequently made, because the difference that is found is due to the difference of position of the seam. Altogether I really think that our friend has not brought out or proved the statement he has made, as I hold the difference is due to the heats, the condition of the apparatus, and whether or not an exhauster is used, and I am bound to say that the greatest deficiency in the amount of light will be found to be very much under the control of the manager himself and not due to the coal. Another remark has been made as to the examination of coals. I pass a number of different coals through my hands, and I never make an analysis without seeing the top and bottom of the seam of coal, and this I do in order to secure a proper representation of the coal. I have the greatest confidence that the coals passing through my hands are analysed with the greatest care, and with the object of purchasing.

Mr. Watson, Stirling—I think the varying pressure of gas at the holder may have something to do with the discrepancy. But again I suppose that coalmasters in sending samples for testing purposes, won't send the worst bits he can get.

Mr. Jas. M'Gilchrist, Dumbarton—I have listened with great interest to Mr. Andrew Scott't first production at our meetings, and to the discussion which ensued. I may say that were it the case that gas managers generally find that the gas obtained from the coal came within ten per cent. of the laboratory test, Mr. Scott would not have read this paper on the subject. It is the experience of us all, or at least of all to whom I have spoken on the subject, that 25 per cent., in many cases, would be nearer the mark than 10 per cent. There is no doubt that, at the present time, there is something radically wrong with our system of testing. I do not say it is the analyst's fault, or that it is the coal master's fault, nor the gas manager's fault; but there it is, that analyses of coal are sent throughout the country that bear no resemblance to the coal you purchase at all. How that is the case I know not. It may be as one speaker has suggested that the coalmaster selects the best coal, and it may also be that he adds some light hydrocarbons—(laughter)—however, the fact is that many gas managers are greatly annoyed by their directors expecting to get the same results from actual working as have been obtained in the laboratory. If it were possible for the system suggested by Mr. Scott, to be adopted, that is, for gas managers to demand of the coalmaster that he abide by the analysis and pay for the shortcomings, always provided that the gas manager uses the best means to extract the gas, it would be a certain cure of the evil; but I am afraid it will be a very long time indeed before we will be able to get coalmasters to sell their goods on such favorable terms. I think the subject is a very appropriate one to bring before the Association; and I move a hearty vote of thanks to Mr. Scott for his interesting paper.

Mr. Jeffrey, Kirkintilloch—I may say not only do some coalmasters send their worst coal, but I have seen in a ton of coal as many as two or three hundredweights of dross. Now what sort of gas can one get out of that kind of rubbish. I think it is in this as much as anything else that the explanation of the diversity is to be found.

Mr. P. Wilson, Stonehouse—Mr. Hislop takes the top and bottom of the coal; but I do not suppose he will go down the pit to see whether there are dykes, where the coal is half burned. The best bits of coal are, doubtless, sent to him for analysis; but if he were to examine the workings he would at once see the difference of the coal.

Mr. Niven, Dunoon—I have looked into a book which I have with me, and I see that I have written down there, that from the analysis of ten different coals a deduction on an average of 8 per cent. from the volume came pretty near the practical working. In inquiring into the conditions under which results are obtained I have no doubt light will be thrown on the subject under discussion; but I was going to remark with Mr. Mitchell, that few, if any, gas managers hold to the analysis. Of course the analysis will be found useful for general guidance. Take any analysis you like and take it as the basis of your calculations, and after making the deduction to which I have referred, you will find that you are very nearly correct. In practical working there is a great deal of dross, wet coals, and other drawbacks, which must be taken into consideration, and which are not considered when the analyses are made. I think the lesson which the discussion teaches us is, that we should take these analyses for our guidance, and on these we can easily base our calculations.

Mr. Adamson, Airdrie—I remember that the results which I obtained when inquiring into the gas-producing qualities of the coal were very similar to those obtained by Mr. Scott. I never yet found in practical working that the gas coal came up to the analysis supplied, and I think every gas manager here will bear me out in this remark. At the same time, I think these analyses are the basis on which gas coal may be fairly put. I think the discrepancy between the actual result in the ordinary manufacture and the results obtained at the laboratory may be accounted for in the majority of cases by the temperature and pressure. During last winter, for instance, when it was so cold, gas was being sold by gas managers in decreased volume compared with what is the case in the ordinary average of years. Gas managers cannot alter the outer atmosphere as the analyst can do in his laboratory. I hold that no proper analysis of coal for a practical gas manager can be made, unless five or ten tons of fair average coals are taken from the colliery. The present mode of conducting such an analysis may in a great measure account for the discrepancy between the analysis and actual results obtained in ordinary practice. I have listened with great pleasure to Mr. Scott's paper, and I trust his remarks will be of benefit to the members.

Mr. Dalziell, Kilmarnock—I think analyses are conscientiously and fairly given. Perhaps the analyst does all in his power in the interests of the coalmaster. Whenever I get an analysis put into my hand, the first thing I do is to deduct 10, 15 or even 25 per cent., and I find, in doing so, I come pretty near the value of the coal. I account for the discrepancy thus—when the analyst gets coals for analysis, they are thoroughly dried and in good condition to be put into the retort. The gas maker gets the coal and stores it in a shed. Here there is always more or less moisture, and when the coal is put into the retort it is not in the same good condition for getting high results as when the analyst has it. Then, again, in the retort house there is not the same care and attention bestowed by the men in charge as when the manager in charge is standing behind their backs. All these things combined may go to explain why we get so much less gas out of the coal

than the analyst. Whilst I think that these analyses are carefully given, I would not take any of them without first deducting from ten to twenty per cent.

Mr. Martin, Kilmacolm—Perhaps these analyses are fair to the coalmaster but they are not fair to the manager. I am in a small work, and I take all the advantage I can out of the coal, and, do what I can, there is generally a difference of about 20 per cent. between the analysis and the actual result. If you take more gas from the coal, you have not the illuminating power. Therefore, I think in preparing these analyses it would be better to allow a little to the manager as well as to the coalmaster. because directors are very apt to say that you do not get the same results out of the coal by 20 or 30 per cent. that a gentleman of position can take out of them.

The President—This has been an interesting discussion upon this subject. We all know that it is a sore point this difference between the supplied analysis and the results got in the actual working, and I think we are pretty much of the same opinion that we cannot get the same quantity of gas from the coal as is on the paper. We usually allow 10 or 15 per cent., and we cannot depend on getting, and we do not expect to get nearer results, there are so many contingent circumstances—in the time lost in charging itself, in the smallness of coal and dross, and in the condition of the coals themselves. The coals are not always clean, and the apparatus for carbonization and purification may not always be in the best condition to do their work, and the same results are not obtained under varying pressures. These contingencies all come in, which prevent the ordinary practical working being equal to the experiments. What would be the use of practical men unless they knew these things? It is different in Scotland from England. In the latter country they have only a few sorts of coals, hile in the former we have a hundred sorts, and it becomes a matter for serious consideration the buying of coals. It would be very unsafe to depend on the analysis of coal as quoted, and I think the best way is to get a truck of coal, try it in the work, and then you can see what it is worth. I do not do that myself. I simply take the printed analysis, and I form an idea of the value of the coal. I know the respectability of the party testing, and I am able to form an opinion as to how far the analysis is correct; but before making an estimate as to how the coal will turn out, I like to see it in bulk. I think we have to congratulate ourselves upon this interesting discussion, and if we can hit upon some system by which these analyses would properly represents the value of coals it would be a great advantage to gas managers.

Mr. Scott—I would, in reply, like to say a word or two in regard to Mr. Mitchell. He deducted something like 15 per cent. from the analysis supplied; but I do not see that that deduction can be of any use when you get amongst the coal such differences as I have referred to.

The President—But all the different coals require different times. Some you may get off in three hours, but shale you won't get off under four hours. The old system used to be to work shale coal for eight hours. I do not think you can work shale coal as a rule under four-hour charges.

Mr. Scott—The results I got were by working both coals under the best possible circumstances, and, so far as I could see, nothing remained in the ash or bulk. It was said in the course of the debate that it was the general opinion of managers that 20 per cent. ought to be deducted from the volume specified by the analysis—Mr. Hislop said about 10 per cent. If coals are to be used in the laboratory, I have no objection to their being used in pounds, but seeing they are to be used in tons in a gas works, I think some other rule ought to be adopted for the guidance of gas managers.

The President—I think it would be an advantage in addition to the laboratory analysis if we were to get a good analysis from actual practical work, but it is not always convenient to do so.

Mr. Mitchell—Any person who reads a properly compiled chemical analysis must have observed that the coal is mineralogically characterised, the volatile matter contained in it described, and the whole thing brought down to the hundredth part of a grain. Now is it possible for any sensible party to take coals and expect to get the hundredth part of a grain at the mouth of an ordinary retort? If the report bore on its face that the analysis was the result of practical working, then certainly the managers would be entitled to expect the full volume, but when it is represented as a chemical analysis I do not see that that can be expected.

A vote of thanks was then accorded to Mr. Scott.

THE LIME QUESTION.

In order to suit the convenience of Mr. Niven, Dunoon, the meeting agreed at this stage to hear him on a question which he desired to state.

Mr. Niven said—The remarks which I have to make are in reference to an important matter, namely, that of lime. In Dunoon I am very much troubled about the disposal of my waste lime. Farmers, in my district, won't take it from me. Now an important process has been going on for some time at Paisley which is said to result in a great saving. So far as I can understand from the history of gas purification, lime will always be a great factor in the purification of gas. Now, in works like mine, the proprietors think that the manager ought to know everything—whether it be with respect to the electric light or the introduction of any new process. As a member of this Association, I have got a good deal of light on many subjects, and I thought if a committee were appointed to investigate this process of the revivification of foul lime a report from it would be of great value.

The President—I do not think there is any necessity for the appointment of a committee. I think there is no doubt about the success of the revivifying process. I have tried it myself, and I am satisfied as to its success. If, however, the first cost is taken into consideration by those who are getting a good price for their spent lime, it is not so much a matter of importance to them; but to those who have to pay a high price for their lime, and who get little for it after use, the process is of great importance. I do not see the object of appointing such a committee, but I will be glad to hear what others have to say on the subject.

Mr. Jeffrey—Kirkintilloch—I have much pleasure in seconding Mr. Niven's motion. This process is not much known, and the sooner it is made public the better. I think a committee should be appointed to inquire and report to next meeting.

Mr. Hislop, Paisley—When I came here I had not the slightest idea that this subject would be referred to. I may say that, at the present moment, I have a circular in proof, a copy of which you will possess shortly, on the subject. I may state that the process has been in operation for a considerable time, but from pressure of other business, I have not had time to get up this circular to which I have referred. It is going on very satisfactorily indeed. I am continually making experiments, and I have been endeavoring up to this time, to improve the process if possible. I think it is now very near perfection, the result of working with shorter chambers than I intended to produce. I get my spent lime restored at a sum not exceeding 8s. 6d. per ton. I am prepared to produce it on any scale. I will be glad to see any person who desires to investigate the process, either from this Association or otherwise. There are a great many inquiries about the process, and I hope to meet these by showing it to gentlemen.

Mr. M'Gilchrist—I think the best thing that an Association like this can do is to investigate any process that may be brought out, and I think the revivification of lime is one of those subjects which ought to be investigated by a committee, for this reason, that managers of moderate or small works cannot be at the expense of getting the apparatus fitted up at the works without knowing its value. Probably, too, that which might be suitable for a large works would be unsuitable for a small works, so I think Mr. Niven's suggestion is a good one, and I would support it. If Mr. Niven would make a suggestion as to who the committee should be, perhaps it would assist in coming to a settlement of the point.

Mr. Niven—The president, vice-president and members of the Association's committee.

Mr. Mitchell—As far as circumstances permit, I will take pleasure in investigating the process.

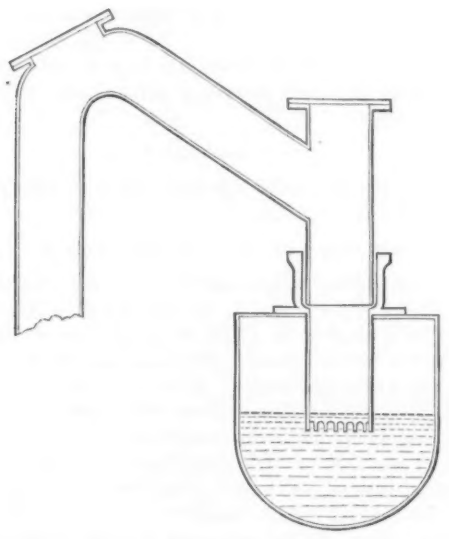
Mr. Dalziell—I see from the *Journal* that some inquiry has been made regarding Mr. Hislop's process, or something near it, but I think we ought to investigate for ourselves.

It was then agreed to leave the matter in the hands of the committee of the Association.

ON THE PULSATIONS ON THE RETORT.

Mr. Robt. Mitchell, Coatbridge, then said—At a recent meeting many of us present were privileged to listen to our much-esteemed member, Mr. Young, deliver a most instructive and highly scientific address on "Some of the physico-chemical laws relating to the manufacture of gas." The first subject treated was the deposit of carbon on the interior of the retort. The theory then propounded was to me very interesting, and had the effect of arousing in me a feeling that a new line of thought had been opened, and which investigation with experiment alone could determine. As I look upon our Association as one for mutual improvement and interchange of opinion, I venture to bring the matter before you, trusting that many members during the winter, in their spare moments, may have been thinking over, and perhaps experimenting on, this important subject; and, if any of us have formed a wrong idea, it may be brought out in discussion. Mr. Young at that time showed, by experiment, the diffusion of gases through porous septa, and then the oscillatory action of the gases in the retort. There was shown a diagram of a dip-pipe which had for its object the breaking up of the gases, and also the prevention of the pulsations inside the retort. The arrangement was very beautiful, but to me it had the disadvantage of requiring the tap to be opened or shut as the passage of the gas from the charges necessitated. To overcome the pressure and the pulsations by some simple means has since been my endeavor. While in conversation with one of the honorary members on the influence of the pulsatory action on the retort, he remarked that he had observed the reduction of pressure, and also the absence of pulsatory action when passing air or gas through a rose-ended pipe, compared with an open or square-cut end. I immediately

set to experiment on this. The rose-end had this objection—its liability to clog. I tried various shapes of openings in half-closed ends and in the sides of the dip-pipes, but found the greatest advantage in using a dip-pipe as sketched here :



I have adopted this method in my new works, where the pulsations and pressure on the retort are reduced to the lowest minimum—so much so that it is scarcely perceptible on the gauge, and the sound in the hydraulic mains can only be heard with difficulty, although there are three ovens of five retorts at work. As to the advantages to accrue from this change I can as yet say very little. I have only had the bench at work something like six weeks, and although the pulsatory action has been reduced, still the carbon on one or two retorts continues to form, while the others ara practically as clean as the day they were set; so that now I am of the opinion that there must be some other cause at work in this formation. In one retort the carbon is in a narrow stripe, in another a broad, flat surface. There must be chemical action or affinity brought into play at certain places, and under certain circumstances. as clearly shown by the manner in which the carbon is deposited. Whether or not I have been able to make any headway in the overcoming of this troublesome deposit, time alone will tell. If the relieving of the pulsatory action is of no advantage, we are not in a worse position than when under the old system.

Mr. Hall—As far as pulsation is concerned on the retort bench, I have made experiments myself. One way I adopted by which I relieved the pulsation considerably was by taking the bottom of the dip-pipe in the hydraulic main, and instead of having it to strike straight, I put notches round the bottom of the dip, and the result is that the beat at my hydraulic main is almost silent. But that can only be done where you are certain there is no heaving of the main, so that the seal may be carried away. Where mains rest on the bench it requires great caution, but you can relieve the pulsation by notching the pipe. By adopting this method I could work with no more than half an inch of seal on the bearing part of the pipe. It wrought with perfect safety, and besides it gave a greater yield of gas and relieved the pressure on the retorts. So far as tne carbon of the retort is concerned, that depends on the action of the fire.

Mr. M'Gilchrist—I think I am right when I say that there is no other part of the apparatus or plant of a gas works that has been subjected to so much discussion as the dip-pipe. To-day we have had another phase of it. We have had it in every conceivable way brought before us; but I think from the date of its introduction little or no improvement has been made on the old dip-pipe. Certainly, in past times we used to work with three or four inches of pressure ; but now it has been clearly proved that one inch is quite sufficient. I have yet to learn that there is any better form than the old dip-pipe with the inch of seal in liquid, but not in tar. I may state that I have visited Coatbridge works, and examined the retort bench, and certainly, if the absence of pulsations are of any consequence in the manufacture of gas, the arrangement shown by Mr. Mitchell is perfect. With regard to the formation of carbon in retorts, I work at the present time, with not more than an inch of seal without any scalloped arrangement (but I take care that the pipe is always sealed in ammoniacal liquor or water), and I have little or no trouble with carbon deposit. I scrape the retorts for the first four or five months every fortnight, and after that I am not troubled to any serious extent. I think I can point to a reason why Mr. Mitchell's retorts at certain places show carbon. I think where two parts of the retort are joined together they are more porous at the divisions than at any other of the parts, and it is the diffusion of the gas between these divisions that causes the formation of carbon. I think Mr. Mitchell has misunderstood Mr. Young at the last meeting in regard to carbon deposit, as I think he modified his ideas in regard to the cause of that deposit. He stated to a meeting that the pulsations were the true cause of the formation of that carbon, but in the six months succeeding that time he had discovered they were not the principal cause ; but that the diffusion of the gas out and in through the porous clay of the retort was the cause of the deposit of the carbon. I think he has had no reason to alter his opinion from that day. From the frequent intercourse I have had with Mr. Young, I may state that it is still his opinion that this is the reason for the formation of carbon in the retorts.

Mr. Renfrew, Langbank—Two years ago I put in a retort, and after working for two or three days the main became unsealed, owing to the expansion of the bench, and this unsealed the dips. I then raised the water to half an inch of seal, and I don't think I had an inch of carbon on the retorts during the whole season. In my opinion, therefore, it is merely a matter of dip. I don't think I have half an inch of dip at the present time, and I am working splendidly.

Mr. Dalziell—I think it is a good idea that Mr. Mitchell has brought forward. At the same time I think there is a great deal in the retort itself. In a smooth retort the carbon does not grow so quick as in the one that is rough. Much, too, depends on the man drawing. If the man is careless in drawing, you will be astonished how quickly the carbon gathers, but I think in connection with a case of this kind it is clear that this arrangement will assist to keep down the carbon in the retort.

Mr. Mitchell, in reply, said—I find that I have seven-eighths on the seal, and I think it is quite sufficient, although it may be a little too much in the opinion of some members. Mr. Hall finds that his bottom retorts always keep clear of carbons when the others are coated. In my case it is the reverse. The three top retorts in my set are practically as clean as they left the work, and the two under ones are beginning to have a coat of carbon.

A Member—Is it the same coal that you always use in these retorts ?

Mr. Mitchell—I work with four mixtures, representing seven coals, and they just take their turn, and the whole of the charges are equalised.

The President—Would not the use of the different varieties of coal produce these different results ?

Mr. Mitchell—It cannot be that in my case, because they are all charged from the same barrow in rotation.

In answer to another question, Mr. Mitchell said the retorts were all of the same size.

Mr. M'Gilchrist—There is difference between Mr. Hall's and Mr. Mitchell's experience, In the one case the extreme heats may be at the bottom, and in the other at the top. No doubt the heat has a good deal to do with the carbon. With high heats you decompose the gas, and, consequently, deposit carbon.

Mr. Hall—It is at the point at the top of the retorts where we have the return flame that the deposit of carbon takes place. In my retorts I may say that you can scarcely detect which of the retorts has the heats—there is a very uniform heat over the whole of them.

The President—We have had this subject brought forward again and talked over. I think we are very much of one mind that the deposit of carbon is not entirely due to the heats, but also to the characteristics of the retorts. If we have light heats and smooth retorts, we will not have so much carbon. At the time of the introduction of exhausters, it was found, by relieving the pressure, that the deposit of carbon was considerably reduced, thus showing that pressure has something to do with the deposit of carbon, due, no doubt, to the retention of the gas in the highly-heated retorts, where it is broken up into its elementary constituents.

A vote of thanks was accorded to Mr. Mitchell for his paper.

THE SEALING OF RETORT DOORS.

A communication from Mr. Menzies, gas manager, Lerwick, was then read.

After describing a sketch which accompanied his communication, the writer says :—In the foregoing it will be seen that all the ordinary apparatus is employed. In doing the work, which is very plain, there is a half-round groove cut in the face of the mouthpiece to receive a three-eighth inch round iron ring, which is fixed by four screwed pins, bored and tapped to mouthpiece. In the door or lid a dovetail groove turned out seven-eighths of an inch, or more, if space will allow. This groove is to be filled with lead, mixed with a small portion of tin, to harden the same, and dressed off flush with the face of door. The melting temperature of lead is far above the heat of any retort mouthpiece. Zinc stands a higher temperature but is somewhat hard for this purpose. The arm can be hinged for either side. The back of hinge must butt close to the arm box of mouthpiece. The tail of arm must fit tight to prevent shaking. The slit in arm must be according to size or depth of bead in ring on mouthpiece, to allow for wear of lead on door, but the same breadth as thickness of pin. The other arm

is hinged at end to carry the screw-bar and screw. A space is cut out of arm at end, to admit the screw-bar, and bored for a pin, and thus hinged. The bead shown in section on door is the ordinary bead cast on retort lids. The iron ring in mouthpiece is half sunk in face, the other half standing out to meet the lead on door.

LERWICK, March 31st, 1789.

ROBERT S. CARLOW, Esq., Port-Glasgow—

Sir: As I promised to give you further information anent my mode of sealing retort doors, I herewith enclose a rough sketch, which I have no doubt you will make out, also an explanation of the same. I have now used this plan for the last six months, and I am perfectly satisfied that it will work. I have only used it in a single retort which I have in a bench. The depth of seal on this retort is 3-inch, which means 6-inch pressure. I consider this a service test. My other retorts are under 1½ inch seal, which will be more favorable for this plan. Now, sir, I must tell you that this retort door sometimes backs the gas; but it is only when any refuse is allowed to gather around the lower part of the head on mouthpiece when drawing the charge. This is easily remedied by scraping off the refuse on each side of the lead. I have exposed the door and mouthpiece to the highest heat I could take on an iron retort, and also placed the door over the barrow when drawing the charge, exposing it to all the heat to try and melt the lead, but I find it stands the heat well; but if too much tin be put in the lead, the tin will melt. You will see in the explanation that I have used all the ordinary apparatus that is useful for lime. I did all the work myself, with the exception of the hinge on arm. The plan is open to many improvements—the head on the mouthpiece could be cast on same; the doors could be made of malleable iron, which would reduce the amount of weight and friction; and some other improvements could be made. I do not know how the plan will work on larger retorts, such as ovals and D-shaped, as I have no means of trying the same. The one I use is 15 inches in diameter. Now, sir, I must ask you to lay this plan before some of my more-enlightened brethren in the South that they may pass their opinion on it. I do not think I have infringed on any patent. I have never seen any patent for this purpose, further than Morton's woodcuts in the *Gas Journal*. I think I have given you all the *pros* and *cons*, but will be glad to furnish any further information you may request; and, hoping to hear from you,

I remain, yours truly,

JAMES MENZIES.

The President—Probably it will be as well to let this communication stand over until a better opportunity for discussing it occurs. I think now an opportunity should be given to the gentlemen who have exhibited articles to come forward and offer explanations. I have often felt that great injury was done to them by breaking up the meeting without getting such explanations.

THE AUTOMATIC PRESSURE REGULATOR.

Mr. W. Cowan's patent automatic pressure regulator was exhibited and explained by Mr. Donaldson and Mr. Paterson.

Thereafter, Mr. Donaldson said that the object of the regulator was not to dispense with the services of the gas engineer, but with the governor man.

The President—It is as well that we have the explanation, because the apparatus seems very clever, and might dispense with them altogether. We are really very much indebted to Mr. Donaldson, of Messrs. W. & B. Cowan, and Mr. Paterson, for exhibiting and explaining this automatic regulator. It is a delicate instrument, and one which shows great skill and ingenuity in its arrangement. I would like to hear what you have to say about it.

Mr. Sinclair, Rothesay—Is it intended for the drawing-room or for practical working?

Mr. Donaldson—This instrument is to work a 24-inch governor at the Phœnix gas works, London.

The President—As there are no other questions to be put, I move that we give a hearty vote of thanks to Mr. Donaldson for sending this instrument, and to Mr. Paterson for his clear explanation.

This was unanimously agreed to.

SUGG'S BURNER.

The President—Mr. D. M. Nelson has been kind enough to send one of Sugg's 200 candle-power burners, and as many of the members have not seen it, perhaps Mr. Nelson will take it apart and explain its mechanism.

Mr. Nelson—I am sorry that there is no arrangement for a lamp to show the burner in operation. This 200 candle size is meant for English gas generally, but we find in Scotland, with gas of 26 or 27 candles, that the illuminating power is equal to 350 or 360 candles. An exhibition of it took place in Glasgow last night, and Mr. Foulis said he had reason to believe that that was the illuminating power of the lamp. It displaced 16 lamps in the immediate neighborhood, which were consuming the same quantity of as, but by means of this lamp the illuminating power was doubled. I came here without the slightest intention of saying a word on the subject; but I shall be glad to give an explanation or information privately to any gentleman who may wish it.

The President—I may say it was intended to have an exhibition of this burner, but as most of the members would be away from town before darkness set in, we could hardly do the burner justice, and it would scarcely be fair to put it up in that way.

Mr. Nelson—The burner, I may state, can be seen any night in operation in St. Vincent Place, St. Enoch Square, Charing Cross, George Square and other places in Glasgow.

THE NEXT MEETING PLACE.

On the motion of Mr. M'Gilcrist it was agreed to hold the next meeting of the Association at Bridge of Allan.

THE UNION OF THE TWO ASSOCIATIONS.

The President—The other matter which claims our attention to-day is a letter addressed to me by Mr. Smith, the President of the North British Association of Gas Managers, in which he has the idea of encouraging the amalgamation of the two societies. I may state that this is a matter which has come altogether from Mr. Smith. It did not come from my side. As you have done me the honor of electing me President, I did not think it would be becoming on my part to be a party to the absorption of this Association in another association. Therefore I would not think of encouraging the amalgamation, especially so long as I was President; and as an honorary member I scarcely think it right to interfere. I think these district associations are of great value, and the success of this Association has shown the advantages of frequent meetings of managers in their own districts. Still there is nothing to prevent union. There could be a central association and district associations, all members of which would also be members of the main association. And then, instead of having two days' meetings, the main association could remit questions to district associations, or matters could come up from the district associations for discussion at the main association. In connection with this Association, however, we have a benevolent fund, and an organization which we cannot readily give up without doing injustice to certain parties. What we want you to do is to take this matter into consideration. We are not inclined to bring the matter forward in a formal way. As it would be unfair to remit to a committee or a single individual, we must remit to the whole of the members, who will afterward discuss the question.

After some discussion, it was agreed to leave the question in the hands of the committee of the Association.

ERRATUM.—In the President's remarks on Mr. Scott's paper (page 8), with reference to coal analysis, his meaning is not clearly brought out. He meant to say that before purchasing he always tested the coals in bulk, and did not rely on the printed analysis.

Institution of Civil Engineers.

On Monday night, May 25, the President of the Institution of Civil Engineers, Mr. J. F. Bateman, gave a conversazione in the Engineering Galleries of the South Kensington Museum. The rooms are long and very narrow, and having only one entry or exit, are about as ill adapted for reception purposes as can be.

The writing telegraph of Mr. Cowper was exhibited at the extremest point from the entrance, and as it attracted many spectators, a perfect block was soon created, and it was difficult to move about. Close to Mr. Cowper, models of corrugated flues, and of his corrugating machine, were shown by Mr. Samson Fox, who has lately introduced an expansion ring into the boilers fitted with these flues, with excellent results. Mr. Bessemer showed several specimens of mild steel cylinders, one crushed flat without a crack. Many points of railway construction and fittings were also illustrated by specimens, among which may be mentioned the automatic coupling of Mr. Brockelbank, and the Acaster rail joint. Tramway construction was also well represented. Mr. Spielman's rail and Edge's grooveless tramway being perhaps the most novel exhibits. Mr. John Dixon contributed a model of Cleopatra's needle, with a wooden model of the stage by which it was raised to its position on the Thames Embankment. A working model of Jordan's patent "dead blow" hand-power rock drill was also exhibited. Of screw propellers several were present, including Griffth's Mallory's and a cycloidal one shown by Lieutenent Armit, which has lately been fitted to Lord Alfred Paget's steam yacht "Amy." A feathering propeller was shown by Messrs. Laird.

No less than six different systems of electric lighting were in operation, and they all illustrated to perfection the peculiar qualities of the light, including its uncertainty.—*Iron*.

Report on the Experiments with Electric Light on the Victoria Embankment.

The joint official report of Sir J. W. Bazalgette, the engineer, and Mr. T. W. Keates, the consulting chemist of the Metropolitan Board of Works, has recently been made public, and is a model of what such a report should be.

For the first time in the history of the electric light, as applied to street illumination, we have a series of data laid before us about whose accuracy there can be no doubt. Hitherto such reports have emanated from either gas managers or electricians, whose interests—wrongly, we think—have been held to be opposed to each other; hence the singular discrepancies in the data which have been issued up to the present time. It must be perfectly understood that we intend in no way to make the slightest imputation against the honor of the authors of these reports, but when one side tells us that the electric light is cheaper than gas, and the other that gas is cheaper than the electric light, we can only account for the discordance of opinion by supposing that the reporters must have been unconsciously influenced by their anterior convictions. In the present instance we have the conclusions of two eminent public officials, who have no other interests to serve than those of the community at large, and who are wholly independent of the advocates or opponents of either system of lighting.

We regret that we cannot follow the reporters through all the elaborate series of calculations which they have laid before us; we can only gather a few of the results of their carefully conducted experiments. One great point which has been decided on the Victoria Embankment is that the steadiness of the liget is in a great measure dependent upon the regularity with which the motive power is supplied to the electric machine. In the present case this uniformity of power was secured by the use of a specially constructed 20-horse power engine, provided with an automatic governor of extraordinary sensitiveness, the whole being supplied gratuitously for three months by Messrs. Ransomes, Sims, and Head, of Ipswich.

The experiments upon which Messrs. Bazalgette and Keates' figures are founded began on January 24, and were continued until February 5, Sundays excepted, or, in other words, for twelve nights—the engine being driven for 5.5 hours each night, the whole 26 lamps being lighted. The mean daily cost of working the engine, including wages, was found to be £1 9s. 8½d., or 3.24d. per lamp per hour. The cost of the whole plant was £1,280, but a smaller engine would be quite sufficient for the purpose; the capital required, therefore, might be reduced to £990.

"The accurate estimation of the amount of light given off by the electric arc and ignited carbons is," say the reporters, "a matter of great difficulty, so much so that the best results which have been obtained can only be looked upon as fairly approximating to the truth." This difficulty arises from two causes: first, from the difference in color between the electric light and any standard of light at our command; second, the fluctuating character of the electric light. The photometrical experiments made on the Embankment were, 1st, on the naked light; 2d, on a light with an opaline globe; and 3d, on a light with a granulated globe. The measurements were made with an ordinary bar photometer, fitted with a movable screen with a star disk.

The standard unit of light which was used was a sperm oil lamp, specially constructed for the purpose by Mr. Sugg, and fitted to the photometer by a peculiar balance, by which the necessity for removing the lamp during the course of any number of experiments is obviated. The unit of light given by this lamp was equal to 16 Parliamentary standard sperm candles. Twenty readings were made on each experiment, both with open and shaded lights—that is to say, 160 on the naked light, 24 with the opaline globe, and 16 with the granulated globe. The following are the main results obtained in these experiments:

Naked light	378.1	sperm candles.
Opaline globe	154.9	"
Granulated globe	265.0	"

The loss of light produced by the opaline globes is 59 per cent.; by the granulated globes, 29.9 per cent.

Taking the above data as approximately correct, the gross output of light from the 20 Jablochkoff candles amounts to 7,562 candles, nearly 60 per cent of which is absorbed at once by the opal globes. There are also two other sources of loss—first, from the greater thickness of the opal glass in the lower third of the globes; second, from the fact that the most favorable direction for the projection of the light from the Jablochkoff candle is upward, there being an actual diminution of light horizontally, and still more so downward.

On the 14th and 15th of March a very important experiment was made, with a view of ascertaining whether the circuits could be increased in length to a considerable degree without diminishing the apparent value of the lights on such circuits. The Westminster and Waterloo circuits—that is to say, the two at each end of the line—were thrown into one, the total length of wire being 7,063 feet, three of the lights being at the Westminster end and the other two at the Waterloo end. The lights burned with apparently equal brilliancy as when short circuited, and on the following day the length of the line was increased to 8,815 feet, or 1.66 miles, but still without any perceptible effect on the light. We believe this is the longest circuit ever attempted to be used with an alternating current machine, and the success of the experiment has a very important bearing on the general question of electric light.

We have said before that the cost of a plant necessary for working 20 Jablochkoff lights is £990. The interest on this at 5 per cent, would be £49 40s., and taking wear and tear at 10 per cent., £99, we get a total of £148 10s. Taking the whole time during which the lamps are lighted in the year at 3,600 hours, say 10 hours a day, the cost of use of plant for each light per hour is 0.49d. To this we must add 3.24d. per light per hour for the cost of producing the light, and 2d. per hour per candle, making a total of 5.73d. per light per hour all the year round.

Let us now compare the cost of gas with the latter figure. The light in the opal globe, as given above, is in round numbers equal to 155 candles, and in the granulated globe to 265 candles. To produce a light equal to 125 candles, one of the larger Sugg burners consumes 48 cubic feet of gas per hour, while to produce a 265-candle light we should require 83 cubic feet per hour. The cost of the former quantity of gas may be taken at 2d., of the latter at 3.5d., or, to put the matter more plainly—

The cost of the electric light is	5.73	per hour.
Gas equivalent to electric light in opal globe	2.00	"
Ditto, frosted globe	3.50	"

We have therefore, at last, a series of figures on this important subject which cannot possibly be doubted. The experiments which have yielded them have been carried out with the greatest care, and every precaution has been taken to render them so correct that all future cavil or controversy will be avoided; the outcome of the matter being that, used in the best possible manner, the amount of illumination in both cases being equal, the electric light costs 1¾ times as much as gas.—*Chemical News.*

Petroleum Production.

Stowell's *Petroleum Reporter* for June 16 sums up the "situation" as follows:

On examination of the tables found in the *Reporter*, giving the production, stocks, shipments, etc., in the producing regions of Pennsylvania each year, commencing January 1, 1870, to the present time, it will be seen that the amount of crude petroleum produced has been steadily increased, with two exceptions, from year to year, until it has reached 7,149,778 bbls. in the first five months of the present year. At the same ratio for the balance of the year a production of 17,500,000 bbls. will be obtained in 1879.

The rate of increase in the production has been up to the present time (June 1) about 315 per cent. The question of controlling the production has for all these years been one of the greatest importance to the trade; but all plans proposed and all attempts made in that direction have thus far proved ineffectual in restraining the producers from opening up new territories and producing the oil wherever found, without regard to the law of supply or demand, which every good business man is bound to respect, and is ready to apply in all other pursuits of life.

Taking it for granted that the production cannot be reduced while the Bradford field with its flowing wells tempt the operator, also while West Virginia, Kentucky, Tennessee, and California are attracting both the capitalist and the operator to their wonderful petroleum fields, which promise to rival Pennsylvania in the production of petroleum at no very distant day; it is apparent that the attention of all parties interested in the trade should be turned to and concentrated upon increasing the consumption of the product.

As a result of careful computation it has been ascertained that the exports of petroleum from the United States constituted about 66 per cent. of the production, and that the home consumption required about 22 per cent. more, making the total consumption 88 per cent. of the production for 1878, leaving a surplus of 12 per cent. By concentrated action on the part of producers, shippers, and dealers, having in view the increase of consumption at home and abroad, the 12 per cent. surplus, which is now increasing, the stock would soon be worked off at paying prices, and a sound continuous market be secured for our present large production, and to cover any increase in the production that it is probable will be obtained in the future.

A very important point to be considered in increasing the consumption is new uses to which the article may be applied, not forgetting, however, that its present uses as an illuminator, lubricator, and for fuel purposes should be extended and increased at home and all over the habitable globe.

Correspondence

Notes from Great Britain.

London May 30, 1879.

A matter which is at the present time exciting considerable attention is the gas supply of our metropolis. As your readers are aware, no doubt, our standard of illuminating power in London is 16 candles, and it is a question if, after traveling so long a distance as it has to from the Gas Light and Coke Company's works at Beckton, the candle power at the consumer's burner is up to the standard. However, be this as it may, there are at the present time numerous complaints being made as to the quality and the great advance in amount charged for gas consumed, without, as the complainers aver, any justifiable cause.

One of the daily papers, the *Daily Telegraph*, has taken up the cause, and its columns contain from day to day letters of the most extravagant character, showing an amouat of ignorance upon the subject of gas, its consumption and measurement, that is really beyond belief. There has at times, I must grant, been cause of complaint, from want of attention and courtesy—both cheap commodities—and the officials in the employ of the gas companies seem to have forgotten that they owe to the private consumers all their prosperity. I am sure that if a little more trouble were taken to teach consumers how to use gas, we should not be under the unpleasant necessity of reading such letters as appear from day to day in the paper before mentioned.

Several gas companies—among them the Gas Light and Coke Co. and the London Gas Light Co.—promote(?) bills in Parliament this session to obtain some or all of the following powers: To manufacture, sell, buy, deal in, fix, remove gasfittings, stoves, etc.; enter into houses, inspect, examine, condemn, replace, and substitute such fittings as, in their opinion, may seem necessary, and exact fines for any breach of the companies' regulations, etc. The two London companies withdrew their bills, but in the case of the London Gas Company a petition to the House of Commons was prepared by the gasfitters of London; as, if the powers sought had been granted, it would have increased the monopoly at present held by the gas companies, and render consumers entirely dependent upon the officials of the gas companies, who would have power to condemn any gasfiitting, and enter into any room to examine them.

There are still several of our provincial gas companies seeking some of the powers enumerated, and the gasfitters and kindred traders have formed themselves into a body. It is their intention to present a general petition against gas companies having such powers. The *Builder* has taken notice of the matter. *Iron* says that "gas companies have just seen what a valuable monopoly was slipping out of their hands, and are employing all their vast resources and influence to strengthen their position." They do not object to gas companies having powers to manufacture, but they say, with regard to the inspecting, examining, etc., of gasfittings: "Every gas consumer knows what he has often to submit to, and he may have some idea of what his gas company would be were these extravagant and unconstitutional demands acceded to." The *Gas Trade Circular and Review* has also devoted considerable space to the subject, and advocates the cause of traders as against gas companies becoming traders. It further points out the injustice to shareholders, and says: "We take it that, as the law now stands, it would be an illegal act on the part of the directors of gas companies to take any part of the subscribed capital and use it for any such purposes as are set forth in the clauses enumerated."

The *Journal of Gas Lighting* takes quite another view of the question, and, with reference to the Gas Light and Coke Company's bill, says: "We are sorry to see it announced that the bill has been withdrawn. It was a measure intended and calculated to benefit the consumer. The company wished for powers to enter consumers' premises and inspect fittings, and if these were found to be not of a quality to answer the consumers' purpose, to remove and replace them with such as would do justice both to the gas and to the consumer." It further says: "It is acknowledged in our police law that people want protection against themselves and their folly, and no class of persons that we know of so much require protection as gas consumers." With regard to the London Gas Light Co. it says: "We are sorry the opinion of Parliament was not taken upon the points raised in the projected measures. It would be easy to make out a very strong case in favor of the supervision of fittings."

The evidence before the Select Committee of the House of Commons to inquire into the matter of electric lighting is about finished. Some very valuable evidence has been given, but it is not thought that the matter is at present ripe for legislature; in fact, it has been given in evidence that almost all the corporations, gas companies, private companies, etc., that sought powers, have struck out the electric light clause, or withdrawn their bills.

The British Association of Gas Managers hold their annual meeting on the 10th ult., at Newcastle, under the presidency of Wm. J. Warner, of South Shields. The papers do not call for any special comment. In my next letter I hope to give a somewhat extended report of the proceedings, As is usual, a large gathering is expected.

There have been a great many exhibitions held throughout the country of gas apparatus for cooking, lighting, and heating purposes. These have in almost every case proved successful, and there is little doubt will tend to increase day consumption. It is much to be regretted that this has not occupied the attention of gas managers before. In some few towns I have heard of a good day consumption, but they are very few.

The report has been published relative to the experiments made with the electric light upon the Thames Embankment. Summing up, the figures stand thus:—Cost of electric light, 5.78d. per hour; cost of gas equivalent to electric light in opal globes, 2d.; the same for a frosted globe, 3.50d. As long as gas does not exceed 5s. 9d. per thousand feet, it is all in its favor.

The Durham miners' strike may now be said to be ended. It has been decided that there should be an absolute reduction in the underground wages of 8¾ per cent., and on surface labor, 6¾ per cent.

Gas Coals rose during the strike about 2s. per ton. They can now be had f. o. b., on the Tyne, for 6s. per ton, less 2½ per cent.

Pig iron is selling at 37s., but the demand has not been good. Pipe founders are doing more work; prices are still low; the smaller sizes being quoted at £4 2s. 6d. per ton.

Gas Light and Coke Company's £100 A. stock closed at 180–181, and £100 preferred stock at 205–210.

Inspection of Plumbing.

The action of the House of Representatives in passing a law appointing an Inspector of Plumbing for the District of Columbia is commendable, in view of the backwardness of other cities, and especially New York, in proposing and carrying through a similar enactment. We presume the efficient health officer of the District, Dr. Townshend, mainly deserves the credit of this step of progress.

An effort was made to amend the bill so that the inspector should be paid by fees collected from persons whose houses were inspected, but we are glad to say it was voted down, and provision will have to be made for payment by a salary. It is very undesirable that any public officer should be tempted to increase his labors in order to multiply his fees. The immediate effect of the fee system would be to make the public suspicious of his disinterestedness.

An official inspector of plumbing should be a man of capacity and of the strictest integrity; fearless in the discharge of his duty, and not dependent for his living upon an uncertainty.

The majority of householders and builders would undoubtedly avoid utilizing his services if they thought they could thereby escape paying a fee. But if the cost of the service was paid out of the public money, no reasonable objection could be made to it.

On the other hand, if an unscrupulous man received the appointment under the fee system he would very naturally be regarded as a "striker," and would prove to be only a burden upon the community. The service to be performed by an official inspector of plumbing is too important to allow any one to abuse the position, and we fear the fee system would surely lead to such a result.

We understand that the Journeyman Plumbers' Mutual Benefit Society is considering the advisability of petitioning the State Legislature to appoint an inspector of plumbing for New York City, and it is high time that a move was made here in this direction.—*Plumber and Sanitary Engineer.*

Connellsville Coke.—Coal in the vicinity of Connellsville, Pa., known as the Connellsville field, is the best adapted for producing coke for smelting purposes of any yet discovered in the United States, and its product is used from Lake Champlain to the Rocky Mountains, wherever smelting is carried on. Not only has it supplanted to a great extent the raw coals of the Mahoning and Shenango Valleys in their own strongholds, but its use has been found advantageous as a mixture with anthracite coal in the furnace of Eastern Pennsylvania and New York. The Connellsville field occupies a space some three miles wide and fifty miles long, the vein being about 11 feet in depth, and yielding some 8 to 9 feet of workable coal. The coal seam is known as the Pittsburg bed of Professor Rodger's report of the first geological survey of Pennsylvania in 1842, and it appears to be geologically an extension of the true Pittsburg seam before spoken of. This coke yields about 89 to 89½ per cent. of fixed carbon and about 9 per cent. of ash, with usually considerably less than one per cent. of sulphur.—*Mining Records.*

THE AMERICAN GAS LIGHT JOURNAL AND CHEMICAL REPERTORY

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WEDNESDAY, JULY 2, 1879.

Official Report of Examinations of Gas for three Weeks ending June 28, 1879, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

June 1879.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
9		17.05	17.16	18.35	17.55	16.17	
10	Between	17.07	17.32	18.08	17.74	16.48	
11	9.30 A.M.	16.65	16.86	18.73	17.62	16.93	
12	and	16.79	17.21	17.87	18.08	16.95	
13	1 P. M.	16.83	17.09	18.24	18.32	16.63	
14		16.87	16.93	17.75	17.94	16.41	
	Average	16.87	17.09	18.05	17.87	16.59	
16		16.52	17.35	17.86	18.42	16.28	
17		16.88	17.57	17.76	18.57	16.32	
18		17.12	17.24	18.47	18.40	16.08	
19		16.88	16.95	18.40	18.41	16.30	
20		16.98	17.08	18.41	18.40	16.47	
21		17.22	17.24	17.93	17.93	16.46	
	Average	16.93	17.23	18.14	18.43	16.32	
23		16.92	17.55	18.19	18.01	16.30	
24		17.27	17.26	18.57	17.98	16.63	
25		16.69	16.96	17.71	18.28	16.46	
26		17.00	16.94	18.08	18.71	16.03	
27		16.49	17.24	17.76	16.62	17.18	
28		16.99	16.93	17.97	18.87	16.91	
	Average	16.89	17.14	18.04	18.58	16.58	

Sugg-Letheby burner.

E. G. LOVE, Gas Examiner.

Labor as a Form of Athletic Exercise.

Open-air labor is the most effective cosmetic, an almost infallible panacea against all kinds of bodily deformity. But the remedial virtue of labor, *i. e.*, sound bodily exercise, is greater than that of open-air life *per se;* for among the rustic population of Scandinavia, Scotland, and Northern Germany, who perform a large portion of their hard work in-doors, we frequently find models of health and vigor; far more frequently than among the inhabitants of Italy, Spain, etc., who pass the greater part of their indolent lives in the open air.

But, besides all this, athletic exercises have a moral value, which our social reformers have strangely failed to recognize; they afford a diversion and a vent to those animal energies which otherwise are sure to explode in debauch and all kinds of vicious excesses. The sympathetic thrill by which the mind accompanies a daring gymnastic feat, and the enthusiasm of athletic contests, form the most salutary, and, perhaps, the only normal gratification of that love of excitement which is either the legitimate manifestation of a healthy instinct, or else a wholly irremediable disease of our nature. The soul needs emotions as the body needs exercise, and the exciting sports of the palæstra met both wants at once. We try to suppress these instincts, but their motives remain, and if thwarted in their normal manifestations they assert themselves in some abnormal way, chemically instead of mechanically, as Dr. Boerhaave would say, by convulsing the organs of digestion, since the organs of motion are kept in unbearable inactivity. In times of scarcety the paupers of China and Siam silence the clamors of their hungry children by dosing them with opium; and for analogous reasons millions of our fellow-citizens seek relief in alcohol; they want to benumb a feeling which they cannot satisfy in a healthier way.

After finishing his day's work the Grecian mechanic went to the gymnasium, the Roman to the amphitheatre, and the modern European and American goes to the next "saloon," to satisfy by different methods the same instinct—a longing for a diversion from the dull sameness of business routine. There is no question which method was the best—the only question is which of the two bad substitutes may be the worse: the brutalizing, *i. e.*, soul-hardening spectacles of bloodshed of the Roman arena, or the soul-destroying poisons of the liquor shops?

DR. F. L. OSWALD.

—*Popular Science Monthly.*

A New Mineral.

A new mineral, artificially produced, has been recently described by Profs. Emerson Reynolds and V. Ball. In the process lately patented by Messrs. Thomas and Gilchrist for the elimination of phosphorus in the Bessemer converter, it is of great importance to have a durable and refractory brick for the lining of the converters. This the inventors have succeeded in producing, and thereby a basic condition of the slag, hitherto unattainable, has been secured.

In the preparation of these basic bricks, which are made of an aluminous magnesian limestone, an oven is used which is lined with ordinary silicious fire bricks, the basic bricks being piled on the floor in direct contact with this lining. The oven is subjected to an intense white heat, and on one occasion after the oven had been broken down on cooling, it was found that the lower layers of the pile of basic bricks had actually passed through the flooring, and the silicious bricks shoped sharply-cut moulds of the edges of the basic bricks where these latter had cut through them. The resultant fused mass occurred partly as an assemblage of semi-transparent crystals, partly in a stalactitic form, with a minutely crystalline structure.

The new crystallized mineral occurred in long prisms, belonging apparently to the monoclinic system; some of the crystals were colorless, others were grayish, and others more or less strongly tinged with green. The hardness was slightly greater than 5, and the specific gravity was equal to 2.934.

The analysis of the mineral proved it to be a bisilicate and a true proxene. Its composition indicates that it is a member of the group of proxenes that includes malacolite and diopside. Messrs. Thomas and Gilchrist have therefore accidentally effected the synthesis of an interesting member of a most important group of minerals of natural occurrence.—*Ironmonger.*

Chloride of Magnesia in Gas Meters.

Owing to the difficulty and expense of obtaining a good dry meter, wet meters are still largely in use, and the question of what shall the liquid be is an important one. Water is, perhaps, the worst possible filling; it freezes in winter and evaporates in summer. Alcohol is free from the former disadvantage, but not from the latter. Glycerine, the use of which was first proposed by Prof. H. Wurtz, is better than either.

A solution of chloride of magnesium has also been tried and found to be excellent, when the gas is free from ammonia, which is, unfortunately, seldom the case, as the white spots on our argand chimneys tell us. Goebel has tried chloride of magnesium, and found that when there is only 0 3 gramme of ammonia in 100 cubic metres of gas, serious results follow in a few months. A part of the salt is decomposed, forming sal ammoniac, which combines with a second portion of the former to form a double salt, magnesia being precipitated as white powder on the clockwork and wheels. The double salt subsequently decomposes, liberating hydrochloric acid. Chloride of magnesia is most effective in purifying gas from ammonia.—*Scientific American.*

Reduction in Price of Gas in New York City.—On and after June 27 the gas supplied by the Manhattan Gas Light Co. will be charged for at the rate of $2 per 1,000 to those consuming less than 10,000 cubic feet per month; to consumers of 10,000 cubic feet and over, the price will be $1.90 per 1,000.

Prices of Gas Coal.

Penn and Westmoreland	$4.50	at New York.
" "	3.50	at Baltimore.
" "	3.75	at Philadelphia.
Despard, Newburgh Orrel, Murphy Run, Fairmont	4.25	at New York.
	530	at Baltimore.
Chesapeake & Ohio	4.50	at New York.
" "		
Newcastle	3.25 to 3.50	
Provincial	3.50 to 3.75	
Cannelton Cannel (by cargo)	8.75	at New York.
Ince Hall	7.25	

The above prices are about $1 per ton below those of 1878.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)

24 PINE STREET, NEW YORK CITY.

JULY 2, 1879.

☞ All communciations will receive particular attention

☞ The following quotations are based on the par value of $100 per share. ☜

Gas Co.'s of N. Y. City.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Central	466,000	50	60	75
Harlem	1,800,000	50	40	45
" Bonds	170,000			103
Manhattan	4,000,000	50	170	175
Metropolitan	2,500,000	100	125	128
" Scrip	$1,000,000		100	103
Mutual	5,000,000	100	65	70
" Bonds, gold	900,000	1000	98	103

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Municipal	1,500,000	100	120	125
" Bonds	750,000		95	100
New York	4,000,000	100	95	100
Nothern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	130
Citizens	1,200,000	20	60	65
" S. F. Bonds.	320,000	1000	100	102
Peoples	1,000,000	10	20	30
" Bonds.	325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	60	65
Nassau	1,000,000	25	55	65
" Ctfs.	700,000	1000	90	95
Williamsburgh	1,000,000	50	70	75
" Scrip		...	90	95
Kings Co	200,000	100	—	70
Union Co. E N. Y...		25	—	50
Richmond Co., S. I.	300,000	...	60	85
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md.	2,000,000	100	95	98
" Ctfs., gold	1,000,000		95	10
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark	918,000	50	100	103
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			128	130
Cincinnati G. & C. Co.				190
Derby of Conn.	160,000	100	60	80
East Boston, Mass...		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.		100	...	—
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	120	125
Hempstead, L. I.	25,000	100	...	—
Jersey City	750,000	20	145	155
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	100	...
Lewistown Maine...	400,000	100	70	80
Lima, Ohio,	60,000	100	--	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	—	75
Long Branch			20	30	40
New Haven, Conn...			25	152	—
Peoples, Jersey City			...	—	80
" " Bds.					95
Peoples of Albany...	650,000	100	—	10
" Bonds	350,000	1000	--	-
Peoples of Baltimore			25	44	48
" Bonds....				106	—
Plainfield, N. J.	80,000	100	—	105
Perth Amboy			25	—	95
Rochester, N. Y.			50	70	80
" Citizens			100	50	60
Toledo, Ohio				95	97
Washington, D. C...	1,500,000	20	—	200
" Scrip	500,000	20	100	—
Yonkers			50	70	80
Woonsocket, R. I....	150,000	100	80	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario...	150,000	40	117½	
Pittsfield, Mass.			120	130
Rondout & Kingston			75	80
St. Louis, Missouri..	600,000	50	73	75
Stillwater, Minn.	50,000	50	—	26
Saugerties, N. Y.	15,000	100	95	100
Troy, Citizens.	600,000	100	---	60
San Francisco Gas-Co., S. Fr'isco Cal.			95	95¼

The following sales were made at auction June 25: 60 shares of Hudson County Gas Light company, New Jersey, at 95; 50 shares of Stamford Gas Light company, Stamford, Conn., at 114; 70 shares Manhattan, New York, at 180½

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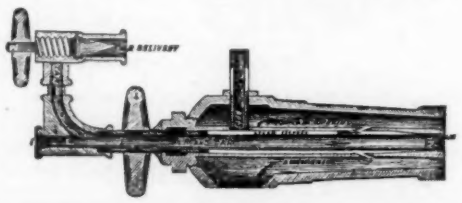

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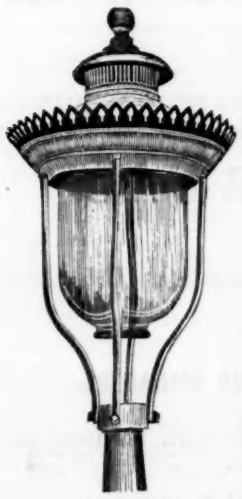

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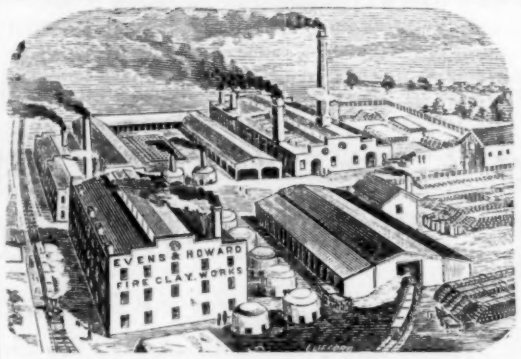

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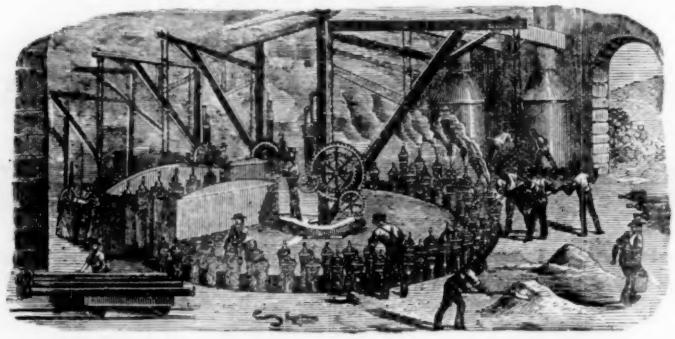

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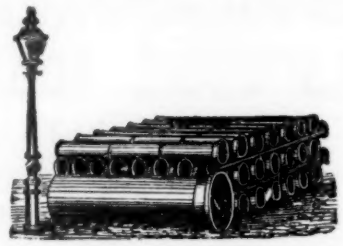

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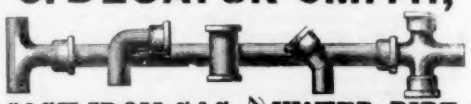

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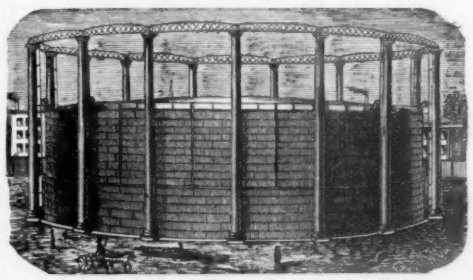

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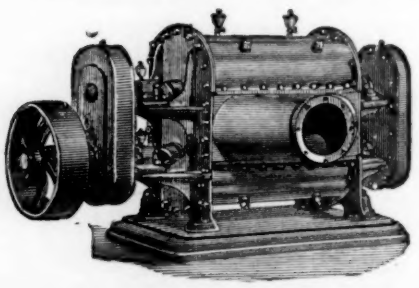

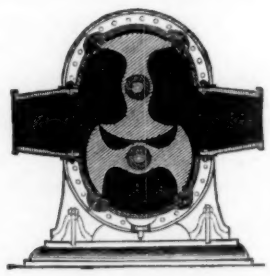

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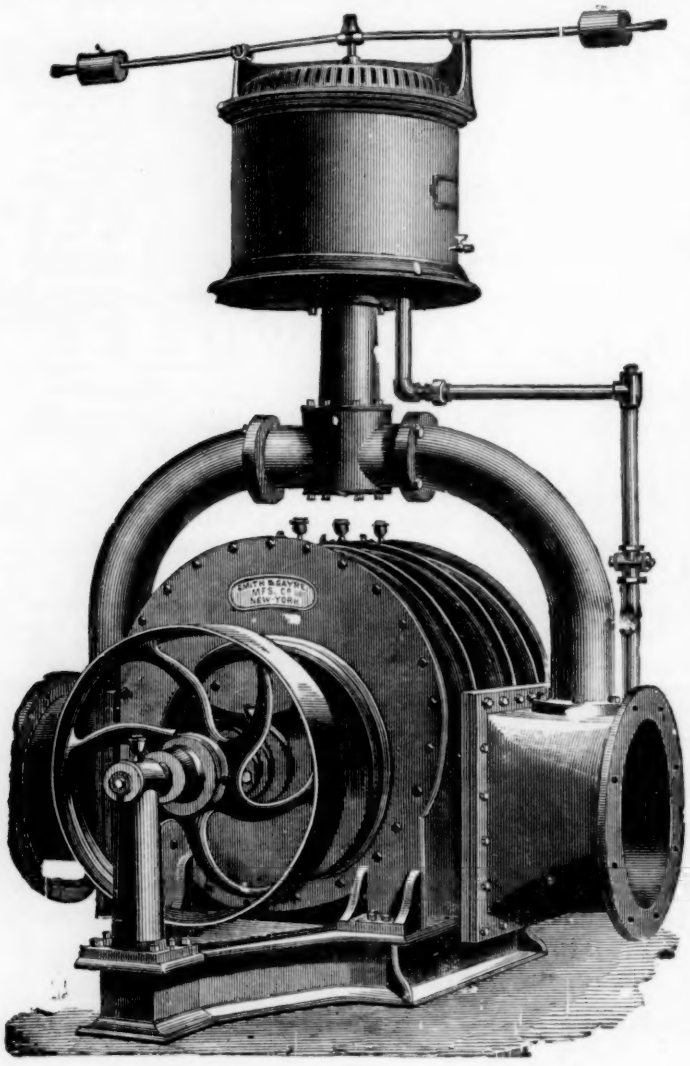

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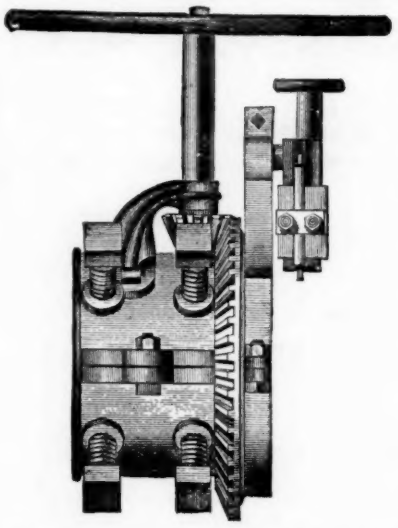

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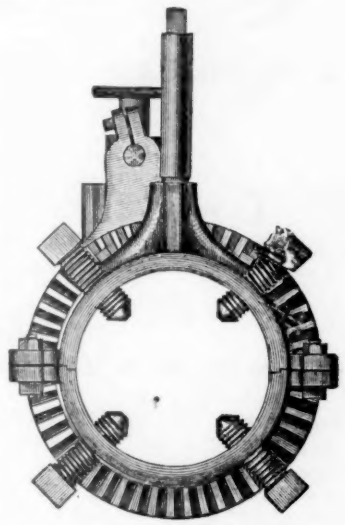

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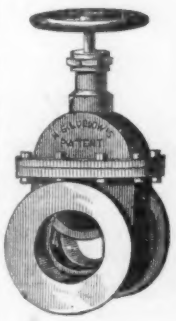

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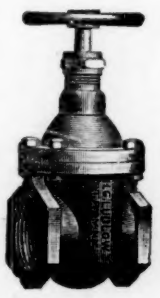

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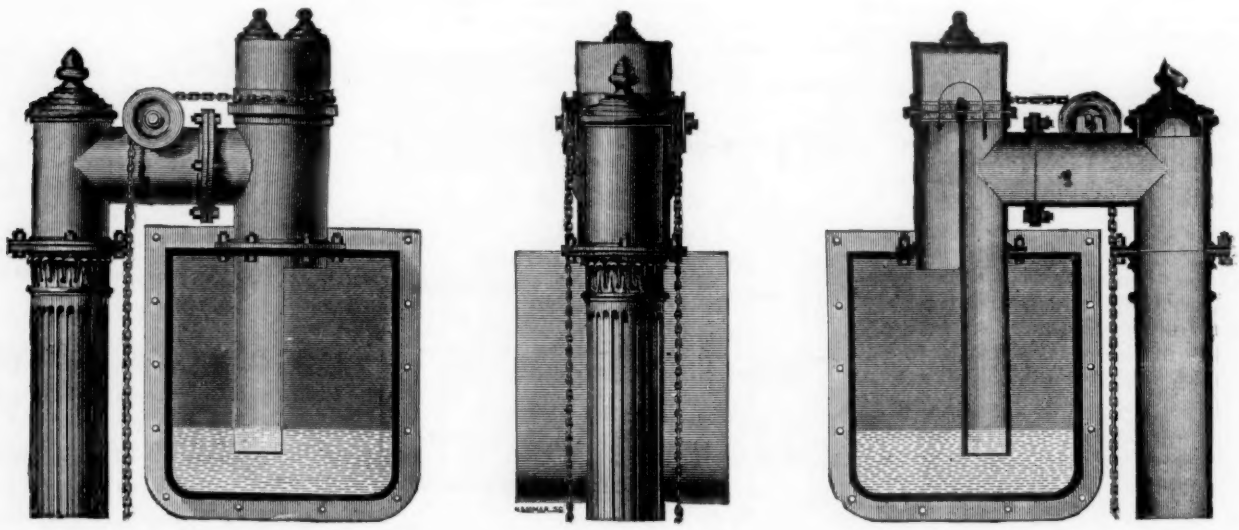

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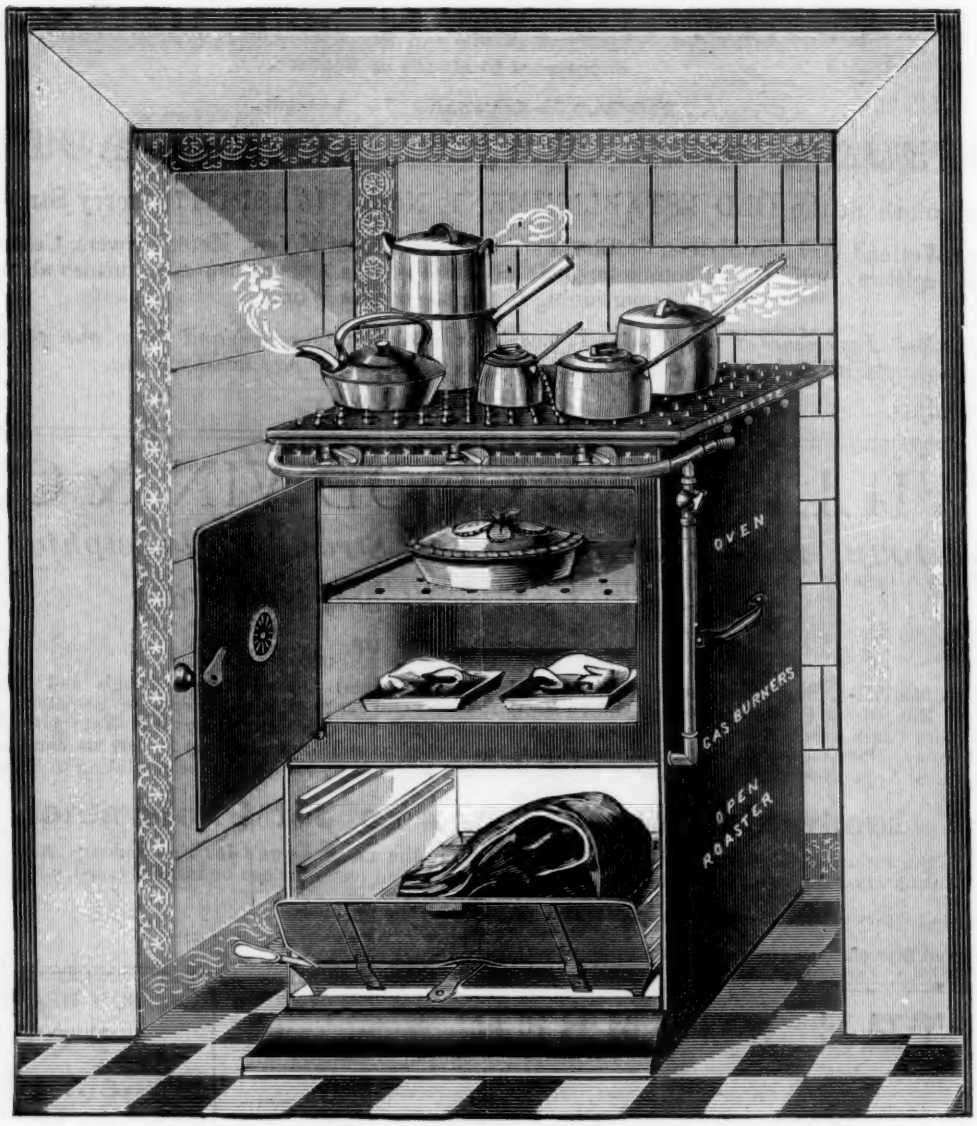

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